DOCUMENT RESUME

ED 169 578 CS 502 422

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TITLE Hearings on the Communications Act of 1978/H.R. 13015; Bell System Statements.
INSTITUTION American Telephone and Telegraph Co., New York, N.Y.
PUB DATE 78
NOTE 122p.; Attachment K removed due to copyright restrictions and poor reproducibility

EDRS PRICE MF01/PC05 Plus Postage.
DESCRIPTORS *Communications; *Federal Legislation; *Federal Regulation; *Hearings; Policy; *Telecommunication; *Telephone Communications Industry

ABSTRACT

Compiled by the American Telephone and Telegraph Company, this book consists of testimony presented by executives of that company before the House Communications Subcommittee on issues raised by H.R. 13015 (the Communications Act of 1978). Some of the topics discussed include the value of a regulated monopoly in telecommunications, the danger of divesting the Bell Telephone System of Western Electric, and the design of the nationwide telecommunications network. (Biographies of the executives who testified are included.) (TJ)

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HEARINGS ON THE COMMUNICATIONS ACT OF 1978/H.R.13015

BELL SYSTEM STATEMENTS

AT&T

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INTRODUCTION

Three years ago the telephone industry called for a Congressional resolution of telecommunications policy problems besetting the nation.

Much has occurred since then to advance that goal, even as rapid technological advancements alter the fundamental nature of our industry. On June 7, 1978, H.R. 13015, also known as the Communications Act of 1978, was introduced in the U.S. House of Representatives by Rep. Lionel Van Deerlin (D-Cal.), Chairman of the Communications Subcommittee, and Louis Frey, Jr., (R-Fla.), ranking minority member of the Subcommittee.

The bill, a rewrite of the Communications Act of 1934, dealt with all aspects of communications, including domestic and international common carrier issues as well as broadcasting. Although H.R. 13015 passed into history along with the 95th Congress at the end of 1978, the effort to rewrite the 45-year-old Communications Act continues unabated.

Regardless of what new telecommunications policies may ultimately be shaped by Congress, the Bell System's resolve to serve the public interest remains steadfast. Where competition benefits the public, it should be allowed to flourish. Where its benefits are enjoyed by a selected few at the expense of the majority, however, we oppose it.

The aim of any new telecommunications policy should be to define the balance between the needs and desires of average users and those of specialized classes of users.

Because the Bell System is committed to assist in defining this balance, we welcomed the opportunity to submit our views on issues raised by H.R. 13015 before the House Communications Subcommittee in mid-1978. A series of hearings on portions of the bill affecting the telephone industry began on July 18 in Washington, D.C. These were followed by seven separate regional hearings in Boston, Chicago, Los Angeles, Denver, Trenton, N.J., Cincinnati, and New Orleans. Eight Bell System witnesses appeared before the Subcommittee at the Washington hearings, and three other Bell System witnesses testified at the regional hearings in Boston, Chicago and New Orleans.

The compilation in this book of Bell System testimony during these hearings records our deeply-held convictions about the issues raised in this bill. It also reflects tenets that not only have served the people of this nation so well in the past, but can continue to serve as the cornerstone for telecommunications policies of the future. □

PART I

UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications

Statement of
William M. Ellinghaus
on behalf of
American Telephone and Telegraph Company

July 26, 1978

Even though much of my testimony focuses on our concerns about certain aspects of the bill, this in no way subtracts from our basic conviction that this legislative proposal is a constructive step toward the development of telecommunications policy that will serve the nation well in the years ahead.

Considering the scope of the proposed bill, I do not plan to deal with every facet of it in this statement. I will leave that kind of detailed analysis to other statements which have been or will be filed with the subcommittee and to the testimony of other witnesses in subsequent days.

What I want to do is to concentrate on the broad policy questions that the bill addresses or, in some instances, fails to address. In doing so, I will be setting forth the views of the Bell System with respect to key provisions of the proposed Communications Act of 1978. But at the same time, my remarks will attempt to look beyond our own interests to the implications for the public—in other words, to consider the impact of the various provisions on the general user of telecommunications.

In this context, we welcome the bill's recognition of the need to foster universal service through the provision of service at just and reasonable rates. And we are pleased with the explicit recognition that revenues from other services have and should continue to hold down the price of basic telephone service.

We welcome the provisions of the bill which would, if we read them correctly, preclude the application of arbitrary constraints on the kinds of technology the telephone companies may apply in serving the public.

We welcome the bill's declared intent to assure that, where competition prevails, it be full and fair competition—and that all parties, including the Bell System, have the right to compete on equal terms.

We applaud those provisions in the bill that simplify and remove roadblocks in the regulatory process, in particular those that cut through the procedural thickets

that have surrounded facility authorization and tariff approval.

Since we are dealing with words and their meaning, however, we do have serious questions and concerns about relative emphasis and intent. For example, should we attach significance to the fact that the Communications Act of 1978 as currently drafted seeks to assure the benefits of communications not to "*all* the people of the United States," as the '34 Act put it, but to simply to "the people" of this country?

As you know, the 1934 Act clearly stated that the overriding objective of national policy is:

". . . to make available, so far as possible, to all the people of the United States a rapid, efficient, Nation-wide, and world-wide wire and radio communication service with adequate facilities at reasonable charges . . ."

In that declaration, the Congress confirmed universality as the aim to which our industry should address itself and toward which our regulators should direct us.

Without question, the goal of universal service has served this country well. It has benefited all facets of society, as well as the nation as a whole. And yet the language in the 1978 bill could be construed to mean that universal service commands a lesser priority than heretofore.

Granted, universal service—in limited terms, such as the availability of a basic telephone and a line to the central office—has to all intents and purposes been achieved. Today more than 90 percent of U.S. households have telephone service compared to 31 percent when the Communications Act of 1934 was passed. But this is not a goal that once reached can be forgotten. The same principles that fostered universal service in the first place are essential to its continued achievement.

And looking to the future, the concept of universality takes on a much broader meaning. We look forward to the prospect of extending throughout our society a wide diversity of communications services matched to the individualized needs of the American people and the institutions that serve them.

I think you will agree that we are a long way from accomplishing universality in those terms.

And so, if a broad diversity of communications services is an objective for the future, I would hope it is not assumed that to pursue a new goal we must abandon the old. I believe we in this country can do both. I believe we can achieve diversity *and* universality.

By my reading of this bill, it is apparent that its authors believe that, too. And I think that with certain refinements in the present wording that belief can be adequately reflected in Sections 101 and 331 of the proposed Act.

Still, we are deeply concerned by the absence of a public interest standard giving sufficient direction to the proposed Communications Regulatory Commission in the exercise of its delegated authority. That standard, we believe, should strike a balance—between the interest of the average user and the interests of specialized users—that we might come to agree represents the public interest.

We also have many concerns as well as questions as to the meaning and the intent of various provisions. There is a serious lack of clarity—even inconsistency—in terms of how the bill's provisions should be implemented. As a result, even though I believe the bill is a sincere effort to end the uncertainties that have beset us over recent years, I feel that in many ways the current draft would generate further uncertainties.

I recognize that what most distinguishes this bill from its predecessor of a generation ago is the reliance it directs regulators to place on the mechanism of the market to serve—and substantially to define—the public interest.

Clearly, competition will work in some areas. But just as clearly, there are aspects of telecommunications where competition will prove a disservice to the public . . . as the bill itself recognizes, in

referring to instances where marketplace forces may be "deficient."

Again, despite this recognition the bill provides no clear-cut public interest standard—and virtually no direction or guidance to regulators, for example, as to what constitutes "competitive" or "non-competitive" services. Nor does it devote sufficient consideration to the problems of meeting regulated monopoly responsibilities in a competitive environment.

There are apparent inconsistencies, too, in the fact that while the bill seeks to assure full and fair competitive conditions, it does not deal with such problems as cross-elasticity between competitive and non-competitive services. And it does not sufficiently recognize the difficulties inherent in being the "supplier of last resort." I fail to see, for example, how one may have full and fair competition when some of the parties to it may pick and choose where and whom they will serve while others—the telephone companies—must serve everybody.

There are, of course, many other unique obligations — public utility responsibilities, if you will—to which the telephone companies must adhere that are quite distinct from those of other suppliers, whose sole obligations are to their share owners.

I am certain that Congress does not intend that the telephone industry seek to abandon a unique public interest standard and to pursue instead the unqualified commercial objectives the marketplace imposes. But I believe that would be an inevitable consequence of the bill as now written. I believe, too, that the telecommunications industry would be transformed in ways beyond this committee's reckoning, beyond any realistic prospect of turning back.

For these reasons, I recommend that the committee devote its most rigorous attention to developing objective criteria that might guide the Communications Regulatory Commission. Where competition makes sense, let there be competition. And where regulated monopoly makes sense, let there be regulated monopoly. First of all, let there be a clear standard for deciding what should be which. That standard, I suggest to you, should be the public interest—construed in terms not of the means to be employed but of the ends to be achieved.

In other words, the threshold issue confronting us is not simply a question of monopoly versus competition but a more fundamental question: What is the basic aim of this country's telecommunications policy?

This aim, I believe, can be simply stated:
It is the widest availability of the reliable, high-quality communications services Americans want and need—at the lowest overall cost to the *entire* public.

Certainly, the Bell System would look forward to the opportunity to direct its efforts to that aim and is ready to be held accountable for its part in its achievement.

But there are some key aspects of the current bill that would preclude the achievement of that aim—by drastically impairing the effectiveness of a telephone system that has provided this country with what is widely acknowledged to be the finest telephone service in the world.

As a case in point, one very fundamental flaw in the bill as it now stands is the inadequate attention it gives to assuring the viability of the nationwide public switched network.

No one knowledgeable in telecommunications needs to be convinced or persuaded that this network is in scale and proficiency a unique national resource. Nor, I am sure, would it be debated that efficient management and operation of this resource are essential if we are to extend to all members of society the growing benefits and expanded capabilities that telecommunications technology promises.

The issue, then, is how best to ensure its viability and how best to ensure the fulfillment of that promise.

What is critical to future progress, in my view, is that there continue to be—at the core of the information infrastructure of this nation—a basic telecommunica-

tions network, designed and managed as one entity. Such a "core" network, a nationwide public network, can serve to link an infinite variety of specialized services—offered by a wide range of suppliers, I might add.

And yet, the indiscriminate commingling of specialized carrier's facilities with the public switched network—as contemplated by the bill—can serve only to fragment, not enhance, responsibility for the efficient, reliable functioning of the millions upon millions of parts that make up the network. As competitive networks proliferate, there inevitably will follow an erosion of economies of scale, and the effective operating, planning and designing that a single, integrated network makes possible.

This is not to suggest that the telephone network won't work, or can't be *made* to work, if responsibility for its design and operation is divided among multiple suppliers. But under those conditions—without a "quarterback" to direct the overall operation—the task will be much more difficult, much more costly, and will result in service of poorer quality.

I recognize that those who drafted this bill sought to confront some of the potential problems in those provisions of the bill dealing with charges for network interconnection and in the proposed creation of a Universal Service Compensation Fund. As you well know, Mr. Chairman —in view of the fact that you and Senator Hollings have written to FCC Chairman Ferris expressing support of the concept —the Bell System's ENFIA (Exchange Network Facilities for Interstate Access) tariff proposal deals with those same problems.

The steps thus provided for in the bill may indeed be useful in assuring equitable charges for the use of the local public switched network. And we recognize the desirability of a regulatory agency establishing guidelines under which the revenues from certain services can contribute to holding down the price of basic exchange service.

We are strongly opposed, however, to the concept of direct governmental administration of such a plan. This would contradict what we take to be one of the basic purposes of the proposed legislation. It would mean more regulation, rather than less. And, in creating what we see as a needless bureaucracy, it would preempt yet another function that can be administered by the private sector in a more efficient and less costly fashion.

I would add that the provisions in the bill fail to confront the problems that derive from the direct competition of Execunet-type services with public switched message services. They fail, for example, to confront the danger such competition presents to the maintenance of nationwide rate averaging. And they fail to address the difficulties that arise in terms of the planning and operation of the network.

Ironically, the bill and these hearings come at a time when the FCC has begun to address the fundamental question of whether the public interest is in fact served by having competition in message telecommunications service and wide area telecommunications service. Both the Chairman of the Commission and the retiring Chief of its Common Carrier Bureau have expressed concern over the possible consequences that can flow from extending competition into still more segments of the telecommunications market. As you know, recent court rulings have carried the present Commission much farther out into the sea of competition than was ever planned when, a decade ago, a prior Commission decided to get its feet wet.

As you well know, it was in the interest of resolving the intercity dilemma that some months ago the telephone industry offered to this subcommittee and to the regulatory community a proposal for restructuring the telecommunications industry. That restructuring was designed to assure multiple supply and competitive pricing in the specialized areas of telecommunications—but without jeopardizing the technical and operational integrity of the public switched

network and the pricing system that provides for low residential and rural rates.

Since the industry plan was advanced at the request of this subcommittee, it is of concern to me that this proposal or some modification of it is not included in the bill.

Of equal concern, in my mind, is language in the present bill which would prejudge the merits of such a proposal and discourage regulators from objectively appraising the degree to which it matches—or might be made to match—the public interest.

I hope that the subcommittee will give most thoughtful consideration to this proposal—and to our urging that the bill include stronger direction for protecting the great national resource that is the public switched network.

Let me turn now to what we consider to be a second fundamental flaw in the bill—and that is the manner in which it proposes to deal with the matter of vertical integration in the industry.

As you know, the recommendation that the Bell System divest itself of its manufacturing and supply unit, the Western Electric Company, has been advanced before. But each time this relationship has been seriously examined by regulatory or governmental bodies it has been upheld.

Most recently, in his recommended decision in the extensive Docket 19129 before the FCC, Administrative Law Judge Kraushaar concluded that ". . . the structure of the Bell System, including the relationships between Western Electric, Bell Laboratories and the operating telephone companies and organizations of the Bell System, serves the public interest. . . ." And, in reviewing that decision, the Commission observed that the "present Bell System structure has generally worked well providing benefits to telephone ratepayers."

Currently, of course, the Justice Department is advocating divestiture. Some —but not all—of our competitors recommend it. And now this bill—by our reading of Section 333—would legislate to the same end.

It will come as no surprise to this subcommittee to learn that the Bell System is profoundly opposed to divestiture, no less so when it is proposed by this subcommittee than when it is proposed by the Justice Department. We believe that a vertically integrated structure is critical to our continued ability to meet effectively and economically the nation's growing communications needs.

Nonetheless we welcome Congress' interest in the matter. The Congress, we believe, is a more appropriate forum for a resolution of this fundamental issue of industry structure than are the courts. Certainly Congressional consideration of this matter would provide a welcome alternative to the hundreds of millions of dollars in costs which the Justice Department's antitrust suit would impose on the public.

We would urge this subcommittee to undertake a comprehensive review of this matter and then take steps to resolve a fundamental conflict in our regulatory and legal system, under which the same issues can be judged both by a regulatory agency under one standard and by antitrust courts under a different standard.

Of course, no less vigorously in this forum than in the courts, we propose to press our convictions that the vertical integration of our business, now almost a century old, has served the public well and that without it the nation will fall far short of the level of communications development it might otherwise achieve in the future.

To put the matter bluntly, it is my conviction that no single action this subcommittee might undertake would more adversely affect the pace of innovation in telecommunications, the quality of the services the consumer enjoys, or the cost of providing them than the fragmentation of the service process that Section 333 would to all intents and purposes accomplish.

I say "to all intents and purposes" because, as I am sure it would be pointed out if I did not take note of it, Section 333 does not literally require divestiture of

Western Electric. Indeed it presents us with a choice.

If at the end of three years, all of the services the Bell System offers are adjudged competitive by the CRC, then presumably we would be permitted to retain the current vertically integrated structure of our business. If, however, one or more of our services should be construed as non-competitive—as the bill itself indicates the public's interest might require—then we would by the current terms of the proposed legislation be denied the advantages of an affiliated manufacturer.

But as much as we, it would be the public that would be disadvantaged in such an eventuality. Consider, if you will, which among our services are most likely to remain—in the public's interest—non-competitive.

Basic exchange service is certainly a likely candidate for exception from this subcommittee's competitive prescription. Another likely candidate should be our message toll service, interstate and intrastate—even though this service is susceptible to competition from other services, our own and those of others, and even though at this juncture Execunet and like offerings by specialized common carriers compete directly with our public message services. It seems very unlikely, however, that there will be a competitive clamor for the right to serve the toll routes of rural America.

At any event, you will recognize that it is the public at large that has the largest stake in basic exchange and message toll services. It is to provide these common user services that the public switched network exists, ready on demand to connect any telephone in the U.S. with any other, whether that telephone be across the street or across the continent. It is the nature of that network that dictates the vertically integrated structure of our business. To work as one it must be designed, built and operated as one. For the services it provides do not begin with the lifting of a telephone or the turning of a dial. The network's service is a continuous process that begins with design and development in the laboratory, and continues uninterruptedly through manufacture and installation to operation in the customer's behalf.

Fragmenting this process would slow innovation by substituting arm's-length relationships for the shoulder-to-shoulder association of research and manufacturing and operating people that now prevails. Indeed, it is to be doubted that so massive an innovation as electronic toll switching could be accomplished at all in the absence of such common dedication and systematic approach.

Destroying that integration would destroy as well the motivations that more than any other I can think of have served to bring telephone service within the economic reach of virtually all Americans. Because Western Electric is affiliated by common ownership with its customers, it is motivated to achieve the lowest cost over the entire service life of its products. And because Western Electric is affiliated, it shares its customers' sense of responsibility for the quality of service.

At the same time, I should point out that the Bell System does not view Western Electric as the sole supplier in meeting the needs of the operating companies. Last year, for example, we purchased more than $1.3 billion in telecommunications products from general trade suppliers.

Taking into account Western's purchases of components for its own products, fully one-third of all Bell System expenditures for telecommunications products go to outside suppliers. And as I am sure you know, we now have pending before the FCC a proposal for a subsidiary to undertake centralized purchasing of communications products and supplies from the general trade.

The point is we in the Bell System recognize that the world of telecommunications is not "ours." We recognize that today there are a great many organizations besides our own whose talents can efficiently be brought to bear on the provision of communications equipment. Thus, our policy is to buy, from whatever sup-

pliers can provide them, the products we need—at the lowest cost over their entire service life. And I think our purchasing record reflects the serious adherence to that policy on the part of the Bell telephone companies.

I can only add that if in this subcommittee's judgment further reassurance is needed to make certain that the interests of the consumer in this matter are fairly and objectively served, then we would invite explicit regulation of any aspect that you suggest, short of the drastic step of divestiture.

Later in these hearings, testimony will be presented in more detail on the strengths of the vertically integrated structure of the Bell System and its advantages to the public. Suffice it for me to say that it is inconceivable to me that the subcommittee intended that those advantages continue in the event that all our services are competitive—but that they should be denied to the public at large in the event that it should be decreed, as common sense suggests it might, that the services we provide in its behalf had best be provided on a non-competitive basis.

I would also like to give some overall impressions concerning Section 332 of the bill.

In one sense, based on the way that Sections 332 and 333 are worded, the bill can be interpreted as giving us the freedom to pursue a wide range of opportunities . . . but at the cost of the divestiture of Western Electric.

We see no bargain in that prospect. For one thing, spinning off Western Electric would effectively emasculate our ability to compete on even terms with others not similarly constrained. For another, divestiture of Western Electric would effectively destroy the Bell Laboratories, a loss not only to the Bell System but to the nation at a time when serious attention is being directed to the need to maintain this country's technological leadership.

But at an even more basic level, this provision might be considered a "Catch 332." To accede to such a tradeoff would be to swap an integral part of the service process for opportunities we do not covet.

In this regard, I hesitate to disappoint those who anticipate Armageddon in what they see as the coming clash between the telecommunications and the data processing industries. Granted that computers and communications are converging, and granted that there may be areas of overlap between the interests of others and our own and therefore competition, I nonetheless want to make it clear that we in the Bell System feel ourselves sufficiently challenged by the tremendous opportunities that lie ahead in telecommunications.

All we seek is the freedom to pursue every technology needed to assure that the telecommunications system in this country—a great national resource for communicating all forms of information including voice, data, or graphics—will continue to be the most efficient and the most versatile in the world.

We have consistently made this position clear. This was the case in our filings with the FCC in connection with the Computer Inquiry. And the same was true in our petition to the Commission on July 10, indicating our desire to file tariffs in the coming year providing for the Advanced Communications Service (ACS). Certainly our intent in offering this service is not to compete in data processing, but rather to enhance the ability of others, large and small businesses alike, to compete effectively and to make the fullest use of this rapidly growing and changing technology.

I would urge the Committee—in seeking to delineate between "competitive" and "non-competitive" services or to define the term "telecommunications"—not to erect artificial barriers between technologies. Such arbitrary distinctions will not only deter the full realization of the potentialities of technology but will severely penalize telecommunications users in the process.

I have just two final observations, Mr. Chairman, both of which concern the nature and degree of regulation proposed by the bill. The first relates to what we

understand to be the intent of the legislation with respect to terminal equipment—and that is, total deregulation.

The Bell System believes that continued regulation is required in order to assure availability of basic telephone service and to establish and enforce appropriate interface standards. While improvements are needed in the enforcement provisions of the current Registration program, those procedures—together with the Primary Instrument Concept, which we continue to recommend strongly for this committee's consideration—are means for achieving service objectives as well as maintaining necessary standards under regulations.

I will add that the bill's general approach to the regulation/deregulation question is troubling to us, simply because—in the absence of any guidance from Congress as to the standards that should apply—we could be effectively removed from sectors of the telecommunications market at the whim of the CRC.

Admittedly, one can view deregulation as a way of opening the door to diverse new markets. But in the Bell System's case, a more realistic view might be that —on the basis of an arbitrary decision to deregulate a portion of the telecommunications market—we would be exposed to antitrust hazards and thereby essentially prevented from offering needed services to the public.

My second point relates to the regulatory framework prescribed in the legislation.

Considering the organization of a new agency, the Communications Regulatory Commission, which will be charged with overseeing the provision of communications services to the public, we have no opinion to offer so long as that agency functions within its statutory mandates.

With regard to the composition of the CRC, however, it seems to me that now is the time for serious consideration as to whether the sheer number and complexity of the issues that will confront the new commission—and now confront the FCC—do not call for establishment of separate agencies for broadcast and common carrier matters.

I recognize that the establishment of a separate agency for the regulation of common carrier matters would mean even closer attention to the affairs of our business than has been the case up till now. I for one would welcome that closer attention if it means, as I hope it would, that common carrier issues could be approached in a more comprehensive manner, and in the context of their long term significance to the public. In this regard, I would concur in the bill's recommendations to provide additional staff support for the commissioners.

Of even more concern to me, however, is the potential extension of CRC's powers into aspects of telecommunications heretofore reserved to the states to regulate. What troubles me about this prospect is the likelihood that the interests of the general users of telephone service will be outweighed by the interests of specialized users in the decisions of the new commission, thus jeopardizing the critical balance which I discussed earlier.

The voice of the average residential telephone user should be heard very clearly—as clearly as the representatives of equipment vendors, specialized carriers, or large businesses. In this regard, it seems to me that each of the states is in a better position to respond to the local needs and concerns of its individual constituents than a single federal regulatory agency.

For these reasons, we oppose the drastic shift in regulatory responsibility from the states to federal jurisdiction. In my view the legislation is deficient in failing to delineate explicitly the role of the states, choosing instead to permit state regulation only at the sufferance of the federal regulatory entity.

As I indicated early on in my remarks, I cannot hope in this brief period to deal with every issue dealt with in this comprehensive legislation. I have not even attempted, for example, to explore the implications of provisions on such important matters as depreciation or the entire

field of international communications. In the case of the latter, Richard Nichols of our Long Lines Department will have the opportunity to testify later during these hearings.

With your permission, statements dealing with these and various other issues will be made available for the Record and for the use of the Committee's staff. We will of course be happy to respond to any questions the Committee may have concerning these submissions. We also would like to have the opportunity to furnish additional materials as these hearings proceed.

I have, as I suggested earlier, focused most of my attention in this statement on the concerns and questions we have with respect to the bill.

In summing up let me reiterate our support for this subcommittee's efforts to formulate a forward-looking telecommunications policy for this country.

However, I want to reemphasize our chief concern with this legislation—and that is the absence of a public interest standard that balances the interests of all users, large or small, and provides guidance to regulators in striking that balance. We sense in this legislation the view that the marketplace is a panacea for dealing with all of the issues currently confronting the industry. While it is clear competition is here to stay in many sectors of telecommunications, I do not see how the market mechanism can substitute for such a standard.

It seems to me, then, that Congress is going to have to give more candid recognition to the unresolved questions this bill raises. In short, more definitive answers are needed to some very fundamental questions:

Does Congress want to assure the continued viability of a public switched network, an infrastructure to serve the communications needs of the nation as a whole?

Does Congress want to deny to the public the proven benefits of vertical integration in the communications industry?

Does universal service remain as a first priority in national policy?

Does Congress want to move fully to cost-based pricing, or should the industry and its regulators seek to preserve a pricing structure which favors residential and rural users and which makes possible nationwide average pricing?

Should the concept of the "carrier of last resort" be discarded?

Does Congress intend that the states should be ruled out completely from this country's regulatory scheme?

In these and many other areas, it seems essential that Congress decide more precisely what it wants—and then provide much more definitive direction to regulators as to Congress' intent. It is by no means an overstatement to say that the future of the nation's telecommunications system hangs in the balance.

For our part, we are convinced that the public switched network—the core of the nation's communications—requires central coordination and unified management if it is to yield services and benefits that *all* may obtain, regardless of the relative profitability involved.

Moreover, we can assess with some certainty the benefits of the long-standing vertical integration of the Bell System which the bill would seek to dissolve.

Those benefits have been amply demonstrated: the pace of implementation of innovation, the price of goods and services provided, and the performance and reliability of this vertically integrated system have, in fact, out-distanced by far the results of those elsewhere who have attempted to provide telecommunications in some other fashion.

In short, we have performed. Indeed, we have outperformed—by virtually any measure you want to apply—other sectors of the economy.

Is it any wonder, then, that we might resist proposals which we feel would tend to dismantle a "system"—a network—in the mere hope that market forces will supplant it with superior quality, superior

reliability to the widest needs of the nation?

For once undone, such a system is not easily reconstituted.

Finally, I would like to restate a point I made earlier, and that is: The question today is not whether there should or should not be competition in telecommunications. That has been settled. Competition is a fact of life in the industry in terminal equipment, in intercity private line services, and in manufacturing and supply.

The question is one of balance. I am convinced that there are areas of telecommunications where the benefits of competition lag the benefits, to society as a whole, of regulated monopoly.

The basic standard, then, it seems to me, that each and every provision of this bill must be measured against is not what the select benefits are for this or that sector of the society . . . but what is in the best interest of *all*.

That interest, call it the public interest if you will, needs defining and protecting.

To conclude my remarks, I would like to quote a paragraph from the Statement of Policy in AT&T's Annual Report for 1977. That paragraph reads as follows:

As earnestly as any other party to the current debate over national telecommunications policy, the Bell System is committed to the development of ground rules for our industry that will assure that the new and diverse communications needs of government and industry and the community are well met. Where competition's advantages to some people cannot be accomplished except at higher costs to most people, we believe we have an obligation to the public to say so. But the aim of public policy, we believe, should be to define that balance between the interest of the average user and the interest of specialized classes of users that, it might come to be agreed, represents the public interest. The Bell System pledges its sincere effort to this end. □

UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications

Statement of
Richard R. Hough
on behalf of
American Telephone and Telegraph Company

July 26, 1978

I think few, if any, would quarrel with the statement that the telecommunications network is a unique national resource essential to the daily social and economic life of the country as well as to its security and national defense. Its benefits are broad and pervasive.

The network enables individuals, businesses and other organizations to communicate, to exchange information in terms of voice, data and graphics. It enables individuals to communicate with one another, to exchange information with computers, and permits computers to exchange data among themselves. In short, it is a resource that enhances daily life and widens the capabilities of business, government and other sectors of our society.

Without high quality, innovative, economical telecommunications the numerous segments of our highly interdependent society could not function effectively. Because telecommunications is basic to so many industries its costs and its efficiency ripple through the economy as a whole. And as we become an even more information-based society, communications takes on even greater importance.

The network itself is a highly complex and dynamic mechanism of some 155 million telephones linked by some 22,000 switching centers and millions of miles of wire and radio paths and millions of billions of possible connections to enable calling across the nation or across the street. And, of course, linked to communications systems overseas via undersea cable and satellite it permits calling around the globe.

Central to the operation of the network is the concept of switching; that is, the ability at junction points throughout the network to connect, as needed, the line of the calling party and the line of the called party. This capability overcomes the problem that, as you add telephones arithmetically the number of direct lines needed to link every phone with every other phone grows geometrically. For while it takes one circuit to connect two telephones, it takes 45 circuits to connect ten telephones and 4,950 circuits to connect 100 phones. You can readily appreciate that such a system would be physically impractical and economically prohibitive.

But, by connecting customer lines to central, commonly used switching points, the problem is solved. In fact, to connect 100 telephones with each other requires but 100 circuits. This is an underlying principle of the network and a fundamental reason we are able to serve the millions of telephones we do. Individual customers are connected to local switching centers, which in turn are connected to switching systems that serve several local centers. This scheme has been expanded until today there are five levels in the switching hierarchy. Each level concentrates the demand from lower level switches over progressively larger areas until at the highest level there are only 10 switching centers for the entire nation.

The addition of direct connecting links or express routes between any pair of switching centers sharing a sufficient calling volume completes the network plan. The public switched network is an effective, economical way of interconnecting millions of individual users with each other, employing thousands of interconnected exchanges.

I believe you would agree that planning, designing and operating such a system would be a complex task, even if volumes and patterns of calling remained constant, even if technology remained constant, even if customers' needs for telecommunications remained constant. But of course that is not the case.

Neither calling, nor technology, nor customer needs are frozen.

So the network cannot simply be a static construction of communication highways and interchanges set in cement; it must be a dynamic system capable of changing to meet changing demands.

This complexity and the need for constant modification make it all the more critical that there be central direction and unified planning, designing, engineering and management of network resources.

Today, under such a unified approach, we have a network that is responsive to the volatility of demand and emergency conditions.

Built into the network is the capability of seeking alternate routes when the first-choice communications paths are congested—so that, for example, a call from New York to Miami, by design and in a matter of seconds, may seek as many as 9 alternate routes and could be routed via a center as distant as Sacramento. (A typical example is the surge in calling on Christmas and Mother's Day.)

In similar fashion, major urban switching centers can be called upon during evening hours to handle calling with facilities that are idle while downtown business activity is at low volume.

Built into the system is the capability of network managers, stationed throughout the country, to, in an emergency, seize back-up circuits—emergency circuits to handle overflows—and piece them together when a natural disaster knocks out a major route in the network.

Built into the system is the capability of blocking out a rush of incoming calls to the site of an emergency—an earthquake in Los Angeles, a blackout in New York—in order that facilities be available for local authorities and affected citizens to make essential calls.

The day-to-day managing of the resources of the network is achieved swiftly and smoothly. It is done without question or debate and with all hands—both Bell System and independent telephone companies—working in partnership, in integrated fashion, for a common purpose: service to the nation.

But unified management of the network involves far more than rapid response to emergencies to facilitate the completion of calls.

It entails looking at the network as a whole rather than its piece parts, in order to plan and design facilities and weave them together in optimal fashion—from the standpoint of quality, reliability and cost of service.

This requires a systems approach to both the provision and management of the network. This provides central control of resources for the development and systematic introduction of new technology and the establishment of design and operational criteria that are essential to high quality service.

This simply could not be accomplished without a cooperative partnership arrangement of the telephone industry, in which the Bell System and 1600 independent telephone companies, while serving their own franchised areas, work jointly to provide nationwide service. They have a common mission. And they have a common economic interest in the effective and efficient operation of the network as a whole.

Such a partnership arrangement also serves to insure technical and operational compatibility within the network.

Key to accomplishing such compatibility is the development of a comprehensive network plan. This comprehensive plan is a technical "road map" which must be centrally conceived and maintained and continuously revised to reflect changing conditions, including long-range preparation for the introduction of new technologies and operating procedures. The precise application of the overall transmission requirements among the millions of connecting paths is necessary in order for callers to hear and be heard. A detailed signaling plan is necessary to transmit the intelligence required to reach any desired telephone. The network hierarchy—the complex nationwide organization of switching systems and the transmission paths—is necessary for the reliable and efficient routing of calls under wide fluctuations in demand. Without a comprehensive network plan there would be no integrated nationwide network; and without the integrated regulated industry partnership there would be no plan.

Data for planning must cover anticipated calling patterns for the nation's thousands of switching installations and must reflect busy seasons, busy hours, classes of calls, and originating and terminating points. Data must be accurate and must

be disclosed without reservation. Information must be locally collected, and utilized centrally, according to established procedures.

As overall network demand is determined, basic planning for the network configuration must be continually accomplished. Optimal network design requires the aggregation of demand in order to effectively utilize the most efficient switching and transmission technologies. Joint partnership activities must develop and continually update long-range plans for handling the combined (local and long distance) switching requirements in major metropolitan areas or states. These plans are then coordinated centrally with similar plans throughout the network and must be consistent with the network overall plan.

Once future needs have been determined, they can, in some cases, be met by making equipment additions to utilize potential capacity on existing routes or by reconfiguring facilities. In other cases, new construction is necessary.

Today AT&T provides the uniform system planning for the network and acts as the nationwide managing partner for the entire industry. As a result, the nationwide telecommunications network is designed, engineered, operated, managed and controlled, as an integrated whole, by a working partnership between the independently owned and operated telephone companies and the Bell System.

The introduction of new technology—vital to productivity, new services and reasonable service costs—is facilitated when one organization coordinates this activity. For example, the introduction of direct distance dialing required a plan for insuring compatibility among all the switching machines throughout the country and development of methods by which these machines might communicate with each other. These improvements had to be accomplished in harmony with existing and new equipment. Such changes require a strong coordinating force to carry them out effectively and efficiently.

As telecommunications technology grows more complex, as digital techniques are extended in the network, as we phase in high volume electronic switching centers, the need for such coordination becomes even more critical.

What I have been attempting to point out is that the very nature of a nationwide public switched network demands a unified approach if the public is to reap the full service and cost benefits that technology is capable of providing.

Today we have such unity. As a result we have a network that provides a high quality service, available to all at reasonable cost.

Before I begin to describe our view of the effects of the Communications Act of 1978 on this nationwide network, I would like to make certain you understand what is involved when one talks about competitive message network services. The way such competition is evolving is not through the provision of competing networks, but rather through the substitution by some carriers of their own facilities for selected portions of the nationwide switched network. Thus, these limited service carriers are able to rely on the telephone companies to provide facilities in places where the limited carriers find it uneconomical to do so. Such a process is, of course, clearly different from what is meant by competition in other segments of our economy.

It is because of this trend that we are so concerned, as Mr. Ellinghaus said, with the failure of this draft legislation to provide to the CRC concrete guidelines as to what extent it should rely on market forces to meet the telecommunications needs of this country. If these guidelines are not carefully thought out, and set out in the bill, the effects on the technical operation and efficiency of the network could be disastrous.

For where we have had unity, we will have fragmentation.

Where we have had a common purpose, we will have competing private interests.

Where we have had the goal of total network optimization, we face the prospect of suboptimization.

Where we have had economies of scale, we will have diseconomies.

That litany may sound like a ringing denunciation of all competition. It is not. I would, however, like to make two observations:

First, here we are talking of a system —small "s"—and systems usually imply a central intelligence or plan. Few systems —from those that drive our wrist watches to those that put astronauts in space—are left to chance and the random interplay of forces.

And, second, the bill itself recognizes, though it fails to provide guidelines for defining them, that there may be instances where marketplace forces are deficient and hence regulated monopoly may need to prevail.

I would like then to turn to the deficiencies as I see them—from the standpoint of public need for service—if there is to be widespread fragmentation of the network among competing suppliers.

First, as distant from competing point-to-point private line systems, this kind of selective message network competition—in which a limited service competitor chooses to supply a high volume, high profit route and joins it with high cost, low profit facilities that we are obligated to supply—has been only a recent turn of events. As a result, I must talk prospectively still about its full effects.

Yet it is clear to me that should the public switched network in effect become a mixture of end-to-end facilities supplied by the telephone companies and pieces supplied by others, the essential unity of the network would be destroyed as well as our ability to manage it.

I spoke earlier of day-to-day management of traffic flow throughout the nationwide network. Re-routing traffic is not an occasional thing restricted to isolated instances of emergency and disaster. A recent study covering just one week showed some 900 instances—involving 150,000 calls—where network managers moved in to shift traffic to bypass congestion and call into play routes that could handle the load.

I cite that study because it underscores in my mind the value of unified network management and the ready access we have to circuits and routes throughout the network. I believe we would lose that capability if the nation's communications were dispersed over the facilities of a variety of competing suppliers.

In similar fashion, I foresee a drift away from optimization of the entire network in terms of design and configuration of network facilities and a drift toward suboptimization. For no longer would we participants have a common objective of network enhancement—some, as already has occurred, would pursue their private interests without regard for impact on the overall network. Such actions are, of course, to be expected in an environment driven solely by market forces.

Another consequence of multiple suppliers of segments of network message services would be the dispersion—or disaggregation—of demand. This can bring a heavy penalty, not simply in duplicative costs but also in slowing the pace of the introduction of large-scale technological innovations that benefit all users.

High volume technologies—such as lightwave and high capacity switching centers—can be economical because, as costly as they are to develop and install, they can yield large savings when the demand is sufficient.

For example, today the Bell System is well along on a nationwide program phasing into the network its latest generation of long distance electronic switching systems capable of processing some 500,000 calls per hour at lower cost per call than any system ever before. Progressive installation of such systems is reducing drastically the number of switching centers and upgrading the performance, the reliability and the efficiency of the network. Yet, it can only yield the economies it is capable of if the demand is there. If the demand is to be siphoned off and spread among the facilities of various other suppliers, the economics could dictate a different choice.

Splitting demand has yet another di-

mension—the inefficient use of network facilities—both domestic and international—and a deterioration of service quality. Through a unified approach to the network, facilities can be employed most efficiently. For example, as I mentioned, residence calling that peaks in the evening can be handled by the facilities that during the day were largely serving business callers.

To the extent that limited service suppliers, who focus primarily on the communications business market, siphon business calling to their own lines, telephone companies lose the advantages of this complementary use of network facilities.

In addition, the presence of multiple competing suppliers could lead to a division of responsibility for handling calls which can most efficiently be handled over a single large group of circuits between switching centers. Instead these calls would be divided among smaller groups of circuits with each group being provided by a different entity. This is not only more costly, but carries a service penalty. Customer calls that encounter blockage on the smaller capacity groups of circuits might well be accommodated on a single large circuit group, instead of getting a busy signal.

The same principle holds true in international communications. Callers in the United States would encounter fewer available circuits if message network services were to be provided over the facilities of non-cooperating multiple suppliers.

I have yet to touch on another serious problem—and that is maintenance. I will do so only briefly. Let me point out that identification, isolation and clearing of network troubles is a continuous process involving the cooperative efforts of all the common carriers. Again, intermingling competing facilities within the network complicates the job.

Under the unified system, the object is clear: find the trouble and correct it. It is not a question of who is at fault, or who should undertake the repair. I submit this would not be the case where multiple, competing suppliers are involved.

In addition, as stored program control and electronic system features are added to the network, testing, as well as operating and management functions can be centralized and thus more economical. This effort is progressing in today's cooperative environment but would be difficult, if not impossible, in a network with a wide variety of facilities supplied by numerous competing carriers.

The loser, of course, would be the public, which would receive less efficient service at a higher overall cost.

The potential problems of opening the network to selective competition cover a wide gamut. For example, one less obvious problem but one already encountered with the international record carriers is the demand that their customers be treated no differently than telephone company customers. The presence of limited service carrier offerings poses special problems which call for procedures that are sometimes different from the procedures for those who subscribe to telephone company services—differences involving such things as dialing procedures, billing, operator handled calling and the like. For example, most telephone company customers need dial only 10 digits to place a long distance call, while subscribers of the limited service carriers are required to dial 13 digits.

If our experience in the international field is any indicator, we are likely to be asked to resolve this difference or, even worse, to ask our customers to dial more digits.

Should this desire for parity materialize, it could add substantially to the price of service generally and result in less efficient, lower quality service.

I have yet to address what remains a core problem. It is linked to the very fundamental goal of providing widely available, high quality, reliable and affordable telecommunications service throughout the country.

It is simply the fact that telephone companies have the obligation to serve all, while the limited service carriers can

elect to serve only the routes they choose and only the amounts of traffic on those routes that they wish to handle, if the network is opened to selective competition.

Obviously, these other carriers will concentrate their efforts on the high-volume, high profit routes as they already have. This leaves the telephone companies with the responsibility of serving the low-volume, high cost routes. Clearly this will increase our costs, costs which ultimately will have to be absorbed by the general residential, rural, and small business customers who stand to gain little or no benefits from competing carriers who generally direct their offerings to large businesses. In addition, the limited carriers' choice of lucrative routes and the resulting ability to undercut the telephone companies' averaged rates may force the abandonment of nationwide averaging of long distance rates. Such a step could mean substantially higher prices for calling between remote areas of the country.

It was precisely these kinds of problems with which the industry has wrestled long and hard in developing the proposal for intercity communications submitted to this subcommittee. I urge that the proposal continue to get serious consideration. It attempts to provide a wide range of opportunities for the competitive supply of intercity service while maintaining the central unity and integrity of the basic public switched network.

While I am sure that some view this proposal as simply an industry tactic to preserve its domain, I assure you it is not —its intent is to preserve the quality and the affordability of service for the public.

In conclusion, the public switched network is a valuable national resource that has served the nation well. It has been designed and constructed by the telephone industry to deliver high-quality reliable service at reasonable cost. Authorizing competitors to selectively provide segments of public switched network services will have major adverse effects on network services for all the using public. Such authorization would fragment responsibility for planning, designing, operating, and maintaining the nationwide network.

The telephone companies have obligations that competitive carriers do not share. The impact of competition with public switched network services will shift an additional cost burden onto residential, small-business and rural customers.

Selective message network competition clearly affects the provision of high quality, efficient and affordable service over the network.

And so I would urge that the subcommittee weigh the evidence and measure it not against a presentiment for any system—competition or regulated monopoly—but against what will best serve the needs of the country.

That, I believe, has been the driving force behind the subcommittee's efforts to date and I am confident it will remain so as these hearings continue. □

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UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications

Statement of
Morris Tanenbaum
on behalf of
American Telephone and Telegraph Company

August 7, 1978

For the purposes of this testimony, I am not going to address the "either-or" aspects of Section 333. In other words, I am not going to deal with the possibility that—if all of the Bell System's services were to be adjudged "competitive"—our integrated structure could remain intact. In his appearance before the Subcommittee on July 26, William Ellinghaus, AT&T Vice Chairman, advanced the view that "for all intents and purposes" the Bill as written would require the divestiture of Western Electric. My comments will be based on that same supposition.

I will not, however, focus narrowly on a defense of Western Electric and its performance.

Rather, my colleagues and I propose to look at the vertically and technologically integrated structure of the Bell System as a whole. More specifically, I will address three questions.

First, what are the reasons for technological integration? Or, to put it another way, why is the Bell System organized as it is?

Second, what are the public interest benefits that flow from this organizational structure?

And finally, what are some of the implications—in terms of service, quality, and cost—of steps that would fragment that structure?

As to the *why* of technological integration, the answer is a simple but compelling one: the need for an integrated structure arises from the very nature of the telecommunications network.

The nationwide network is by far the most complex assemblage of electrical and electronic equipment in the world. And yet, it must be ready at all times to make any of the millions of billions of possible connections between each of the more than 155 million telephones in the country. During a typical day, it must handle more than 500 million calls. More than 3 million people may be using the network at this moment to transmit voice or data. Five minutes from now, a new

pattern of 3 million people may be using the network to reach different parts of the nation or the world.

The complexity of the network and the demands placed upon it require an unparalleled degree of coordination and compatibility among its parts and functions.

Everything must work with everything else. Each of the network's billions of components—regardless of its vintage or type—must be designed, built and operated to work compatibly with every other part.

And because of its complexity, as well as the critical services the network provides, each of its parts must be reliable to an extraordinary degree. The new families of electronic switching equipment, for example, are designed for an objective of two hours of downtime during an expected service life of 40 years. This resulting requirement on components exceeds even the demanding military specifications of the Department of Defense, and is far more stringent than that for general purpose commercial computers.

Meeting the requirements for compatibility and reliability is essential to obtain high levels of performance even from a static technology. But the network technology is dynamic . . . and the pace of technological change is accelerating.

In addition to new technology and services, the network is constantly subject to still another kind of change—additions and rearrangements made necessary by growth and changes in demand for service. On any given day, such changes are going on in more than 2,000 of the central offices and transmission centers across the country. I might add that all of this activity must be coordinated by AT&T Long Lines, Bell Laboratories and Western Electric, which have—within their records and the knowledge of their people—the full history of the network and the nature of its component parts.

No other creation of man—including our most complex defense or space systems—places similar demands on compatibility or change. This places a tremendous responsibility on the Bell System for planning, the selection of methods and types of equipment, and the invention, production, installation and maintenance of the billions of pieces essential to the network's workings.

It is these requirements that set the telephone network apart and demand a "total systems approach" to its planning, development, and operation. It is these requirements that demand the nationwide network be designed and managed as one entity. And it is these requirements that have led to the evolution of the Bell System's integrated structure. In short, the nationwide switched network —because of its complexity, the dynamic nature of the demand and technology that spurs its growth and change, and the essentiality of the services that are afforded the public—has dictated the structure of the Bell System, not the other way around.

With these thoughts in mind, I would like to give you a very brief description of the key functional units of the Bell System, and how the "total systems approach" is embodied in this integrated organization.

AT&T, as the parent organization, provides policy as well as detailed day-to-day guidance in the development of technology and customer services. The General Departments of AT&T assure the Bell System's ability to meet emerging customer needs by bringing together—in one place—the service and technological requirements of the Operating Telephone Companies, a detailed knowledge of present technology, and an in-depth understanding of the potential of future technology. All major new technological projects are undertaken under the general guidance of these headquarters groups.

The fundamental mission of the Bell Laboratories is to assure that the Bell System will have available the knowledge and technology essential to meeting the nation's current and future communications needs.

Even though Bell Laboratories is most often thought of as a research organization, basic research accounts for only about 13 percent of its total effort. The bulk of its activities are devoted to engineering and detailed design. All of Bell Laboratories' activities are guided by its systems engineers, who match telephone company needs with the opportunities arising out of new technology.

Western Electric is the Bell System's manufacturing and supply unit, and as such is managed solely for and in the interest of the Operating Telephone Companies. Western Electric frequently is viewed only as a manufacturer. It is important to this discussion, however, to recognize that Western Electric carries out a host of other essential functions for the Operating Telephone Companies and is closely involved with the work of Bell Laboratories as well.

Long Lines is the operating arm of AT&T. It constructs, maintains, and operates the long distance network which interconnects Bell as well as independent telephone companies. In effect, Long Lines serves as a "managing partner"—coordinating the growth of the interstate network, as its facilities and routes are continually reconfigured under an overall technical master plan.

The 23 Bell Operating Telephone Companies concentrate on local and regional service needs. Let me point out, however, that the basic mission of the Operating Telephone Company—to meet the public's demand for high quality telecommunications service at the lowest possible cost—is the same mission which sets the goals and dictates the activities of all of the units of the Bell System.

Our mission is to serve—and to fulfill that mission the service process must be a continuous one, extending uninterruptedly from the creation of knowledge, to invention through development, manufacture and supply to customer service.

In light of this mission and the demanding nature of the telecommunications network, the benefits of a technologically integrated structure are clear. The primary benefits of Bell System integration—to the individual units and, more importantly, to telecommunications users—are these:

1) It permits a "total systems approach" to the telephone service. Planning, research, invention, design, development, manufacture and operations are directed toward a single objective.

2) It assures the necessary compatibility, reliability and quality of equipment needed for optimum network function.

3) It facilitates and speeds innovation in the complex, interdependent network.

4) It assures that the demand for telephone equipment and service is met quickly and reliably.

5) It provides substantial cost advantages. In addition to the many other economies the Bell System achieves through integration, I would point out that Western Electric's prices for telecommunications products average about 20 percent below those of the lowest general trade supplier, thereby saving the Bell Operating Telephone Companies $1 billion per year.

My fellow panelists will offer further testimony to the many advantages of an integrated organization in telecommunications. The results speak for themselves. This nation has the largest, most advanced and efficient telecommunications network in the world. Thus, it is clear that the approach we have taken in this country works—and works well. Can a different approach, a nonintegrated approach, work equally as well? My answer is no. There must be a centralized plan and control of the overall process—there is really no choice in the matter. The only question is, "What is the optimum way to achieve that control in the public's best interest?"

The factors which have led to the Bell System's structure are not unique to this country. Although the United States network is significantly larger and more advanced than those of other countries, the problems faced by foreign telephone administrations are not basically different

from our own.

And other nations have approached the problem in a variety of ways, some closely similar to the Bell System. Sweden and the eastern provinces of Canada are served by organizations with integrated structures very much like the Bell System. And—I believe not coincidentally—the service they offer is among the best outside the United States.

The Japanese are also building a first class telephone system, using a form of *de facto* integration with suppliers which is characteristic of their cooperative industrial approach.

In Western Europe, the telephone systems purchase their equipment from selected private companies through complex allocation procedures. If you've been to Europe, even quite recently, you will know that the quality of telephone service there is noticeably below that of this country—even though major expenditures have been made for research and development.

And paradoxically, while Section 333 would appear to call for fragmenting the integrated structure of the Bell System, others, both here and abroad, have argued in favor of greater integration so as to effectively develop and acquire complex systems.

It is also of interest to note that the electric power industry, which for decades depended on nonintegrated suppliers for its research and innovation, has with the establishment of EPRI (Electrical Power Research Institute) moved in the direction of a more centrally directed technology. As a not-for-profit cooperative endeavor, EPRI funds and coordinates a $200 million program for the electrical industry. It was established with the strong encouragement of the Congress and the National Association of Regulatory Utilities Commissioners (NARUC).

Any examination of these or other alternative modes of advancing telecommunications in this country will, I believe, convince you—as it has convinced me—that the Bell System's technologically integrated structure is a uniquely valuable resource that should be preserved.

All of this raises a question as to why—given the demonstrable advantages to the public of having an affiliated manufacturer in a technologically integrated structure—the matter of divestiture is included in this bill in the first place. The recommendation that the Bell System divest itself of Western Electric has been advanced before. But each time that this relationship has been seriously examined by regulatory or governmental bodies it has been left undisturbed.

I can only speculate, then, that the rationale for Section 333 rests on concerns that the present technologically integrated structure of the Bell System may somehow thwart the intention of the bill to increase competition in telecommunications. I must further speculate that those concerns center either on the ability of nonaffiliated manufacturers to sell to the Operating Telephone Companies or on the possible cross-subsidization of Western Electric products which would result in unfair competitive advantages to the Operating Telepone Companies.

I would like to address both of those possible concerns.

First, it has not been our intent—nor our practice—to establish Bell Laboratories as the sole source of innovation nor Western Electric as the sole supplier of equipment to the Operating Telephone Companies. Last year, fully one-third of all Bell System expenditures for telecommunications products went to outside manufacturers. The long-standing policy of the Bell System is to buy the best equipment available from any reliable source. Several years ago, the Bell System's Purchased Products Division was established in AT&T to enhance the execution of that policy. To further support the ability of the Operating Telephone Companies to take advantage of general trade products, we now have pending before the FCC a proposal for a subsidiary which would undertake centralized purchasing of communications products and

supplies from the general trade.

I have noted from transcripts of earlier testimony in these hearings much concern about cross-subsidization between telecommunications services and the need for improved accounting systems to prevent such problems. It should be understood that Western Electric's accounting systems provide great and accurate detail on the costs of each of its products. These systems are regularly audited and have been examined and confirmed by the regulatory agencies. Thus this concern is also easily laid to rest.

However, the most important point I must make is this: Western Electric is a manufacturer of communications equipment, yes—and we think the finest such organization in the world—but Western Electric is not just a manufacturer. Most importantly, it is a critical link in the entire innovation and service process that has created this Nation's unequaled telecommunications network. The effectiveness of this process depends on close coordination and precise, systematic organization of resources. Separating Western Electric from Bell Laboratories on one hand and the Operating Telephone Companies on the other would destroy this process.

It would obstruct innovation by disrupting the close working relationships that link the people who make telephone facilities to the people who design them and the people who operate them. Now, more than ever in the past, research, product and process development, and service are intertwined.

Divestiture of Western Electric would deny the telephone companies—and their customers—the advantages of an affiliated manufacturer committed not to objectives of its own but to theirs.

Because Western Electric is linked in purpose to its customers, it assumes responsibility for providing products of the exacting quality that good telephone service requires at the lowest cost over their entire service life. It also continuously addresses itself—whether it confronts competition or not—to reducing the cost and improving the performance and reliability of its products.

Because Western Electric shares the responsibility for the performance of the nationwide switched network, it stands ready to provide whatever components of that network the Bell System's operating units might require—a replacement for a piece of apparatus made 40 years ago or the product of the most advanced electronic technology.

Because Western Electric's mission is the Bell System's mission—that is, service—the company provides its customers, the Operating Telephone Companies, continuous assurance of delivery of the products they want on a where-wanted, when-wanted basis. Western Electric also stands ready to move immediately and unhesitatingly to help restore telephone service to our customers, whenever and wherever it might be interrupted.

In short, divestiture would remove a critical link from the innovation and service process—thereby destroying the common purpose and necessarily close interaction between the innovator, the implementer, and the operator of the technology upon which our telecommunications system is based.

The Congress should also be aware that the divestiture of Western Electric is also likely to result in the massive fragmentation of Bell Laboratories. Western Electric is totally dependent on Bell Laboratories for product design and could not exist as an independent, competitive manufacturer without highly capable design groups, such as those in Bell Laboratories that serve it now.

Not only would such fragmentation further debilitate the Bell System's ability to continue its outstanding performance, it would also effectively destroy the structure in which the Bell Laboratories/Western Electric team has functioned as an important national resource.

Bell Laboratories and Western Electric have, on many occasions, served the nation's interests in defense preparedness and space exploration. Following World War II, Bell Laboratories and Western

Electric were called upon to establish Sandia Laboratories, which managed the nation's effort in atomic weaponry. The same team has been a major contributor to the nation's air and underwater defense systems.

During the Apollo manned space program, at the request of NASA, AT&T established its Bellcomm subsidiary using resources of Bell Laboratories and Western Electric in order to provide systems engineering support for the program.

The Congress should be conscious that this unique resource would be massively fragmented by the provisions of Section 333. This would occur at a time when the nation is deeply concerned about its leadership in technological innovation.

The parts of my testimony and exhibits that follow this introduction elaborate in more detail as to: 1) Why the nature and complexity of the Bell System's responsibilities have dictated our integrated structure; 2) how the public has been well served by this organization; and 3) what adverse consequences might result if this integrated approach to service is fragmented. It also addresses other consequences to the nation's technological leadership and possible implications for international trade and domestic employment.

In light of the Bell System's performance record and the repeated recognition over the years of the benefits flowing from its technologically integrated structure, the structure of the Bell System is a matter of national concern. It impacts the infrastructure of our society and has ramifications for prosperity, employment, national defense and this country's position in the world. I repeat Mr. Ellinghaus' recommendation that responsibility for deciding whether that structure serves the national interest rests with the Congress, not the FCC or the proposed Communications Regulatory Commission and not with the courts. Accordingly, I urge that the Congress provide for a thorough examination of the values of the present structure of the Bell System. It is my own conviction that based on such an examination you will conclude, as I have, that the present structure has operated, and continues to operate, in the public interest and that Section 333 should be deleted.

THE TELECOMMUNICATIONS NETWORK

Why has the technologically integrated team of the Operating Telephone Companies, Bell Laboratories, Western Electric and AT&T achieved its position of leadership in telecommunications innovation and industrial research and development? Why do we maintain that this structure is critical to the nation's future leadership in telecommunications innovation? Why do we urge you to recognize that the destruction of this structure would have profoundly negative consequences? The answers to those questions derive from an understanding of the nature of the telecommunications network itself.

Complexity and Capabilities

As Mr. Hough has testified, the telephone network is the most complex, interacting assemblage of electrical and electronic equipment in the world today.

The network has billions of switches, relays, transistors and integrated circuits, hundreds of millions of miles of wire, cable and radio circuits, myriads of on-line test, measurement and route control devices, and a multitude of different varieties of input and output terminals—deployed in thousands of cities, towns and rural areas.

Despite this complexity, the faint electrical impulses from a voice falling on a transmitter—or a pulse of information generated by a computer—must find their way through this maze of equipment quickly, accurately and reliably, even though the strength of long distance calls may have to be amplified trillions upon trillions of times. Simultaneously, the network must accommodate the public's diverse needs for a wide variety of other services—facsimile, audio, video and

data. The network must also be capable of being reconfigured, providing for alternate routes when needed in times of natural disaster or other emergencies. It must have flexibility to handle the increasing demand for service each year. And it must mesh—compatibly—the newest generation of technology with those still usefully in place after 10–20 or more years of service life.

Because of its capabilities and the basic human needs it serves, the telecommunications network has become an integral part of the social and economic fabric of our nation. Its reliable operation is critical to our daily lives. Its continuing evolution—in terms of service variety, flexibility and quality—is an important element in the nation's progress.

Compatibility and Reliability

The complexity of the network and the daily demands placed upon it require a degree of coordination and compatibility between its parts and functions which far exceeds that required by any other industry. Specifically, each particular piece of plant, regardless of its vintage or type—whether telephone set or data set, wire pair or coaxial cable, switching equipment or carrier system—must be designed, built and operated to work campatibly with every other part. The performance of every part depends upon the quality and technical compatibility of every other part—all must function in unison and in dynamic balance. An incompatible or distorted signal can cause interference with hundreds of other signals, adversely affect service at distant locations, tie up switching machines, cause service outages and wrong numbers, and lead to inaccurate accounting and billing information.

The level of complexity is so great that frequently the requirements for compatibility cannot be completely anticipated in formal specifications but are the fruit of experience and learning under actual operating conditions. And that experience and learning must be promptly reflected in changes in design or process of manufacture in order to meet the inexorable discipline of compatibility.

Because of its complexity, size and the critical services the network provides, each of its parts must be reliable to an extraordinary degree. Again, formal specifications of end point requirements are often inadequate, and reliance must be placed on detailed understanding and control of manufacturing processes and materials, and on the rapid response of design and manufacturing engineers to incipient or actual field troubles. In view of this it is not surprising that Bell System developments in the theory and application of quality control and quality assurance procedures have been adopted by designers, manufacturers and purchasers all over the world.

An example of these reliability requirements can be found in telephone switching. The new families of electronic switching equipment are similar in many ways to large computers. However, in view of its critical function in the network, electronic switching equipment is designed to operate trouble-free for all but two hours of its 350,000-hour (40-year) service life, a requirement far more stringent than that of general purpose commercial computers.

Staff Report No. 5 of President Johnson's Task Force on Communications Policy concluded that the "network's exceptional reliability requirements set it apart." The Bell System and its customers cannot tolerate commercially accepted levels of reliability. That is why it must go beyond formal specifications and resort to process and materials controls, and why design and manufacturing engineers and network operators must work together closely—without proprietary organizational barriers—to assure that the necessary requirements are met in practice.

Technological and Physical Change

Meeting the requirements for compatibility and reliability is essential to obtain the necessary performance from even a static technology. But the network technol-

ogy is dynamic. It is subject to a continuously increasing rate of technological change.

Technological change in the telephone network involves at least two critical problems. First, changes must be compatible with what already exists or serious waste and disruption of service may result. The modification or adaptation of existing equipment is often required and must be carefully planned and minimized. Second, changes must be accomplished without adding unnecessarily to the multiple varieties of equipment, which would increase current costs and make future changes more difficult and expensive.

In short, technological change in the network is itself a complex matter. For example, there are now four general types of local switching offices and five major kinds of transmission systems in use, as well as a number of variations of each. And there is currently under active study a major new type of local central office and two new types of transmission systems. Messages in different forms—such as voice or data—originating from many kinds of terminals must be switched by any existing type of office and carried by any type of transmission system in the network.

In addition to new technology and new services, the network is constantly subject to still another kind of change—additions and rearrangements necessitated by the growth and changes in demand for service. Those changes must also be planned in advance and implemented without interrupting or degrading service. Again the requirements for compatibility and reliability truly are staggering, and it is those requirements, as much as any of its other characteristics, that set the telephone network apart and mandate the technological integration of the Bell System.

And what is the focus of technological integration? Its focus is elegant in its simplicity, but intensely complicated in its realization: To optimize technological innovation and to bring the fruits of new technology on line in a timely, orderly fashion in order to meet the diverse telecommunications needs of the nation at the lowest overall cost to the entire public.

About the Future

The introduction of electronic switching, which began in 1965, heralded a new era in the evolution of the network. Electronic Switching Systems (ESS) are controlled by a "stored program." This is a computer program stored in the electronic memory of a powerful and highly specialized computer that controls the operation of high-speed switching mechanisms. The stored program greatly increases the power of the switching system, enabling it to perform a wide variety of functions and permitting those functions to be changed as technology makes new functions possible. For this reason, electronic switching systems are sometimes referred to as "intelligent" systems because they can be "taught" to perform new tasks.

Today there are over 1,600 electronic switching systems in the network, each representing an investment of from several hundred thousand dollars to several million dollars. New systems are being added at a rate of more than one per day; electronic "intelligence" is rapidly spreading through the network.

Recently we began to add an important new capability to the network called Common Channel Interoffice Signaling (CCIS). CCIS is a high-speed data network interconnecting the electronic "brains" of electronic switching systems, enabling them to pass information rapidly between switching systems all over the nation. This is creating a new capability which we call the Stored Program Controlled Network. It will allow the network to evolve from a large number of independent "intelligent" switching systems to an "intelligent" network—nationwide in scope and totally integrated. This will greatly increase the efficiency of the network, permitting us to complete transcontinental long distance calls five to ten times more rapidly than is possible today and at a lower total cost. More important-

ly, it will offer us opportunities to provide a wide variety of new telecommunication services, greatly enhancing the customer's ability to use the network.

At the same time, the "intelligent" Stored Program Controlled Network will place even greater requirements for compatibility on each part of the network. For example, complicated data messages will be sent at high speeds between switching centers which will have to interpret them and take immediate action—without error. Thus, the requirement for integrated innovation, planning, implementation and operation will be even greater in the future than it has been in the past. Again, the ability of the Bell System to provide this Nation with the world's first Stored Program Controlled Network is a direct result of the technological and vertical integration of the Bell System.

As I have already said, the forces which have led to the evolution of the Bell System's technologically integrated structure derive from the basic nature of the telecommunications network itself.

With that in mind, I would like very briefly to describe the technologically integrated structure of the Bell System, particularly as that structure is geared to the advancement of technological innovation.

THE BELL SYSTEM'S ORGANIZATION FOR TECHNOLOGICAL INNOVATION

From a functional point of view, the Bell System can be subdivided into four parts: Operating Telephone Companies; Bell Laboratories; Western Electric; and AT&T. Attachment A is a graphic presentation of the organization.

The Operating Telephone Companies

The 23 Bell Operating Telephone Companies are probably the Bell System entities most familiar to you and your constituents. Attachment B shows the location of the 23 companies. They serve approximately half of the land area of the United States and about 80 percent of the telephones in the nation. These companies together with the Long Lines Department of AT&T are the owners and operators of the $100 billion (book value) telephone plant, and they employ approximately 80 percent of the Bell System's personnel.

The mission of the Operating Telephone Companies is to meet the public's demand for high quality telecommunications services at the lowest possible cost. To carry out that responsibility the Operating Telephone Companies constantly need and use new technology that improves the services and makes them more economical. They and AT&T Long Lines are the builders and operators of the network. They select the equipment, decide on its deployment, arrange for and assist in the construction of the network, and operate, maintain and rearrange it as required.

Bell Laboratories

Bell Laboratories is the largest part of the Bell System that is devoted entirely to the creation of technology. It employs over 17,000 scientists, engineers and supporting personnel.

The headquarters of Bell Laboratories is in a complex of three locations in New Jersey, each no farther than 50 miles from one another. However, approximately 30 percent of Bell Laboratories' professional technical staff is located in Colorado, Georgia, Illinois, Indiana, Massachusetts, Ohio and Pennsylvania, at or in close proximity to major factories of Western Electric.

The fundamental mission of Bell Laboratories is to assure that the Bell System will have available the knowledge and technology required to satisfy the current and future communications needs of the people of the United States. This is accomplished through an extensive program ranging from the most basic research in broad areas of science that are likely to have relevance to telecommunications, the applied research demonstrating the technical feasibility of new concepts, and extending through to the final design of all of the equipment, apparatus

and components required by the Operating Telephone Companies. All these activities are guided by Bell Laboratories systems engineering, which matches Operating Telephone Company needs with the opportunities arising out of new technology.

Bell Laboratories is jointly owned by AT&T and Western Electric, with each owning 50 percent of the capital stock. The principal efforts of Bell Laboratories are funded by these two corporations. AT&T, on behalf of the Operating Telephone Companies, funds the basic research, applied research and systems engineering activities, while Western Electric funds all of the work associated with the specific development and design of communications equipment. Because the major part of the effort is required for specific development and design, Western Electric pays approximately 55 percent of Bell Laboratories' expenses for the four classes of activity, and AT&T pays the balance of about 45 percent.

Western Electric

Western Electric employs approximately 150,000 people; it manufactures the major part of the telephone equipment used by the Operating Telephone Companies. As shown in Attachment C, Western Electric's manufacturing operations are carried out in twenty factories—with Bell Laboratories represented at 8 of them—located in 17 states. Western Electric's factories and the 8 associated design laboratories are specialized by product families to achieve economies and efficiencies of scale. The principal products manufactured at each Western Electric factory appear in Attachment D. In addition to manufacturing, Western Electric provides other functions for the Operating Telephone Companies, such as systems equipment engineering, equipment installation, warehousing and distribution, equipment repair and recycling of scrap (Attachment E). All told, Western Electric carries on its activities from locations in 36 states.

It is extremely significant that, as a matter of policy and practice, Western Electric is managed solely for and in the interest of the Operating Telephone Companies. I will expand on the importance of that in a moment.

AT&T

The fourth element in the Bell System's integrated structure is the American Telephone and Telegraph Company. AT&T is composed of the Long Lines Department and the General Departments.

Long Lines constructs, maintains and operates the long distance network that interconnects the Bell and independent operating telephone companies. The General Departments serve as the staff organization for the System and provide guidance and management for the Bell System as a whole. The Long Lines Department is intimately involved in planning and implementing new technology. However, I would like at this point to concentrate on the crucial role the General Departments play in promoting and supporting advances in telecommunications technology.

As I mentioned earlier, AT&T—through the General Departments—funds the basic research, applied research and systems engineering activities of Bell Laboratories.

As the parent company of the Bell System, AT&T is responsible for coordinating all Bell System operations and for providing advice and assistance to the Operating Telephone Companies on matters of common interest. The engineering components of the General Departments—staffed chiefly by engineers with experience in the Operating Telephone Companies—coordinate the activities of Bell Laboratories and Western Electric and, together with the Marketing groups, define the general purpose and direction of Bell System technology. The General Departments also rely on the expertise of engineers from Bell Laboratories, men and women who are assigned to AT&T on a two- to three-year rotational basis.

By melding and coordinating the backgrounds and skills of these people, AT&T

can combine in one place the general and specific technological needs of the Operating Telephone Companies, a detailed knowledge of present technology, and an in-depth understanding of the possibilities of future technology in meeting customer needs. The AT&T engineering groups do not do research or engineering development. They are management groups in the full sense of that term. All new technological projects in the Bell System are undertaken under their general guidance.

THE ADVANTAGES OF THE BELL SYSTEM'S TECHNOLOGICAL INTEGRATION

The unique character of the basic telecommunication network demands unified planning, development and operation to optimize its performance and economy. These demands can be best served through a unified structure with common goals. This structure allows for a free and open exchange of ideas and knowledge without the barriers of trade secrecy and conflicting interest. The Bell System and the independent telephone companies, because of their common commitment to service, have evolved a relationship facilitating optimization of the network under the technological leadership of the Bell System.

Bell System Policies

Although each Operating Telephone Company has a direct responsibility to its customers, its state regulatory agencies and its public investors, AT&T as the parent organization is responsible to its public investors and is accountable for the Bell System's overall performance in serving the telecommunications needs of the nation. In the areas of technology I have been addressing, AT&T provides policy guidance as well as detailed day-to-day counsel in the evolution and deployment of technology.

To meet its responsibilities to the public and its investors, AT&T constantly seeks to improve the total managerial and technological process. The interests of the Operating Telephone Companies must be foremost, since they are the providers of telecommunications service and represent by far the major part of the Bell System's investment and the chief source of earnings on that investment.

Although Bell Laboratories has been the principal source of innovation in telecommunications, the Bell System has adopted useful innovation irrespective of its source. An important function of Bell Laboratories is to assure that the Bell System is aware of new ideas and knowledge that might be useful in telecommunications, wherever the ideas or knowledge might arise. To this end, Bell Laboratories people are active in national and international professional societies, as contributors to trade and learned journals and as participants in technical meetings and scientific symposia.

There is further evidence in our patent policy. Although the Bell System's patent licensing agreements have served as a useful source of revenue, they achieve the more important goal of assuring that the Bell System has access to non-Bell inventions at reasonable cost.

As I have said, Western Electric is a crucial link in the chain connecting invention to practical innovation. However, it has not been our intent—nor our practice—to establish Western Electric as the sole supplier of equipment to the Operating Telephone Companies. Thus, the Operating Telephone Companies purchase the best product available regardless of source. Approximately one-third of the telecommunications products purchased by the Operating Telephone Companies in 1977 represented the manufacturing efforts of companies other than Western Electric.

The FCC, in its final decision in Docket 19129, pointed out that the Bell System recognized the importance of purchasing the best, most economical telecommunications products, regardless of source:

It is of critical importance to telephone ratepayers that the BOCs (Bell Operating Companies) procure the highest quality communi-

cations equipment available at the most reasonable cost. Indeed, it is the BOCs' public duty to do so and our statutory obligation to hold them to that duty. 41/

41/ To its credit, we believe Bell management has consistently acknowledged its public duty, e.g., ID para. 45. We believe that the Bell System has performed well overall in carrying out its duty. (FD para. 63)

AT&T has established the Bell System Purchased Products Division to facilitate the ability of manufacturers other than Western Electric to sell to the Operating Telephone Companies, and we have proposed to the FCC the creation of a separate subsidiary to further improve that ability. So, to the extent that Section 333 rests on a wish to make sure that other suppliers are able to sell their products to the Operating Telephone Companies, I know that capability exists today, and we continue to search for ways to improve it.

In short, the source of products or inventions is not of concern to us, so long as what we and others invent or produce enhances the Bell System's ability to fulfill its commitments to the public it serves and to the investors who provide the capital which makes it possible to honor service commitments.

Bell Laboratories and Western Electric Roles

Bell Laboratories' responsibilities for basic research, applied research, systems engineering and specific design and development have made it possible to couple knowledge and invention to practical application rapidly and effectively. The single motivation of the management of Bell Laboratories is to advance technology in the interests of the Bell System and the public it serves. That motivation, combined with an open and free exchange of information and the ability of Bell Laboratories to move individuals between its various functions, has made it possible for the Bell System to narrow the timespan between technological discovery and the broad availability to the public of the benefits and economies of innovation. Conversely, any barriers in the flow from basic discovery to specific development would greatly reduce the effectiveness of the innovation process.

The close interactions between Bell Laboratories and Western Electric are of equal importance. Western Electric does not have a product design organization of its own and is, therefore, totally dependent upon Bell Laboratories for new product development. Similarly, Bell Laboratories depends primarily upon Western Electric to implement its design accomplishments. The two organizations are thus totally integrated and interdependent from the technological standpoint.

It is broadly recognized that an optimum product cannot be designed without good knowledge of how it will be manufactured. Often, small changes in the design or manufacturing process will fundamentally affect the cost and quality of the manufactured product. It is essential that the design of a product be carried on with the closest possible interaction between the designer and the manufacturer. The ability to achieve this interaction has been a cornerstone of the success of the Bell Laboratories/Western Electric partnership. It is for this reason that a substantial part of the design process is carried on by Bell Laboratories people working at or near Western Electric manufacturing plants.

Just as the designer must anticipate the manufacturing process, there is also great advantage if the manufacturer can anticipate the nature of future designs. In the Bell System this has also been done with great benefit. Twenty years ago, Western Electric established its Engineering Research Center, which is located in New Jersey close to the major headquarters of Bell Laboratories. This Center is dedicated to advance research in manufacturing processes. By achieving an intimate association with research and development at Bell Laboratories, the Center is able to anticipate the nature of products that must be manufactured ten or more years in the future. With this knowledge, it can advance the development of manufacturing processes in anticipation of

these future demands. The Center has been very successful, having developed processes which are universally used in the manufacture of integrated circuitry, the first practical application of the laser in manufacture and many other broadly recognized achievements.

When it was established, Western Electric's research center was unique in industry. Since then, it has been emulated by other major manufacturing concerns.

With Bell Laboratories working simultaneously for and with both the Operating Telephone Companies and Western Electric, it is in a unique position to know 1) the *possibilities* coming out of basic and applied research for providing new and improved devices, systems, materials and methods; 2) the *needs* of the Operating Telephone Companies for such innovations; 3) the *requirements* to be met by them for use in the Operating Telephone Companies; and 4) the *results* that can be obtained in manufacture. The integration of this knowledge within the Bell System facilitates the optimal response to specific needs within the dynamic operation and growth of the network as a whole: Its fragmentation and dispersal as a result of divestiture would have the opposite effect.

An allied matter is the determination of the steps to be taken in modifying or replacing designs. With integration, modifications are introduced as required and complete new designs are made when the System's needs or overall economies justify it. Network improvement is not delayed or frustrated while nonintegrated designers and manufacturers with independent interests negotiate the details and finally agree to incorporate the necessary modifications. These problems would be particularly serious in the case of major network innovations such as CCIS and the Stored Program Controlled Network which require extensive redesign and modification of existing equipment in the field on a knowledgeable and coordinated basis to assure timely availability to the public.

As I pointed out earlier, Western Electric is managed solely for and in the interests of the Operating Telephone Companies. Three areas where this is most apparent are 1) innovation, 2) supply intervals, and 3) prices and profits.

1. Innovation

With Bell Laboratories responsible for designing and specifying the equipment that the Operating Telephone Companies need, and with Western Electric's obligation to manufacture and supply the products designed and specified by Bell Laboratories, the manufacturer cannot control the pace of Bell System innovation. In general, manufacturers prefer to make large quantities of equipment whose basic design features remain unchanged for substantial periods of time; the aim, of course, is to maximize profits until the threat of a competitive product is perceived. These preferences are not available to an integrated and controlled supplier such as Western Electric. The rate at which new technology is introduced by Bell Laboratories and Western Electric is determined solely by the anticipated benefits to the Operating Telephone Companies and their customers, even though this may disrupt Western Electric's manufacturing processes and result in reduced volumes of product sales. An example of this can be found in three decades of the history of production of microwave radio systems.

Microwave radio is the backbone of the long distance interstate network. Since the introduction of the first long-haul microwave radio system by the Bell System in 1948, the capacity of these systems has been improved more than sevenfold. As a result, the Operating Telephone Companies and the Long Lines Department have been able to reduce by hundreds of millions of dollars the investment, which otherwise would have been required to increase the capacity of the network. This, of course, has meant the loss of hundreds of millions of dollars of sales for Western Electric. A nonintegrated manufacturer acting at arm's-length could not

be expected to subordinate its interests similarly. During this period, Bell Laboratories and Western Electric have been the primary innovators of these higher-capacity, long-haul microwave radio systems. This innovation has been driven by the internal motivation to improve network efficiency, not by external competitive pressure.

Today we are in the final stages of field trial of a major new innovation—single-sideband microwave radio—which will further triple the capacity of current microwave radio routes. This is another unique Bell Laboratories/Western Electric innovation whose introduction is again driven not by the manufacturer's interest but for the benefit of the user.

These innovations in microwave radio represent only one illustration of the Bell System's unmatched record of innovation in all areas of telecommunications. My colleagues will describe others.

It has been suggested by some that the Bell Laboratories should continue its traditional roles, but that it should work with any interested manufacturer in the same manner in which it currently works with Western Electric. I do not believe that this is possible. The suggestion evidences a lack of understanding of the nature of the interaction between designer and manufacturer to assure effective and timely innovation. The interaction between Bell Laboratories and Western Electric occurs without barrier or restraint. As parts of the Bell System, they serve the common goal to which I have referred frequently. Their common objective is to serve the Operating Telephone Companies, and their employees are measured and rewarded on the basis of their contributions to meeting that objective. They have no separate proprietary interests. There are no trade secrets between them. Cost and performance trade-offs are made on the basis of providing the best product to the Operating Telephone Companies in the most timely fashion and at the lowest cost.

Independent manufacturers must serve their independent owners. In addition, it is obviously impracticable even for an organization of the size and competence of Bell Laboratories to work on the same basis with multiple manufacturers. Moreover, many telecommunications equipment manufacturers are also competitors of the Operating Telephone Companies, compounding the problems with which Bell Laboratories would be faced in dealing with them. Contracting with unaffiliated manufacturers pursuing their own interests, and in the uncertain atmosphere inherent in a complex and advancing technology, would require different arrangements which would sacrifice present advantages of the Bell System's integrated structure, and with penalties costly in money and time.

2. Supply Intervals

In expanding capacity to meet long-term forecasts of customer needs, unaffiliated manufacturers must understandably operate in their own interests, providing that productive capacity which is consistent with their objective of maximizing their profits to their investors. Such motivation can substantially increase the intervals required to procure large, complex systems.

As recently as 1975, nearly 25 percent of telephone equipment orders in Great Britain were running behind delivery schedules—schedules twice the length of Western Electric's delivery schedules to the Bell System. A 1974 Report by a British Post Office/Industry Team, which studied Western Electric's delivery interval performance, states:

We offer no magic formula for the Bell System's success in achieving short lead times. The integrated structure, the commercial environment and the full, free flow of information between the research, design, manufacturing, installation and operating arms of the Bell System are of course important in maximizing resources and minimizing lead times.

Western Electric, as an integral part of the Bell System, must give first priority to the equipment requirements of the Operating Telephone Companies. It must be prepared to meet those requirements

with the necessary manufacturing capacity, even though providing such plant expansion in advance poses economic risks because of forecasting uncertainties. The incentive to undertake such obligations without a contractual commitment is a unique characteristic of Western Electric as an integrated manufacturer of the Bell System.

Moreover, as the integrated supplier of the Bell System, Western Electric can economically meet the shifting demand requirements of each of the Bell Operating Telephone Companies and do so without economic penalty to them.

3. Prices and Profits

As an integrated manufacturer owned by the regulated Bell System, Western Electric's prices must be reasonable; specifically, the price of each product must be based on its costs, and Western Electric's profits must be reasonable as well. Western Electric has met those requirements, and it is subject to continuing and close scrutiny by the FCC and state regulatory agencies to assure that it continues doing so.

Western Electric has kept its prices low over an extended period of time. Attachment F shows that since the beginning of 1950 to May, 1978, the price levels for Western Electric's manufactured products have risen only 38 percent as compared to an increase of 201 percent for the Bureau of Labor Statistics (BLS) price index for durable manufactures and 148 percent for electrical machinery and equipment. If, for the period 1950 through 1977, Western Electric's prices had risen in line with the BLS indexes, sales of its manufacturers to the Bell Telephone Companies would have been priced between $30 and $40 billion higher, and rates for telephone service would have been significantly increased. Attachment F also shows that Western Electric achieved its remarkable price performance despite increases of 164 percent and 138 percent in the prices it had to pay for raw materials for apparatus and equipment, and for cable and wire, respectively, and a rise of 373 percent in its wage rates. These cost increases are broadly similar to those experienced by other manufacturers.

Currently, as shown in Attachment G, Western Electric's prices for its products average 20 percent below the lowest prices for comparable telecommunications products available from the general trade. Moreover, Western Electric's products are often superior in function and reliability.

If Western Electric were divested, it could immediately raise price levels about 20 percent and still have prices that were below the lowest prices available elsewhere. Such a 20 percent price increase would cost the Operating Telephone Companies about $1 billion per year. Consequently, telephone subscribers would pay higher rates.

Because of its affiliation, Western Electric cannot take advantage of the uniqueness of its products, their superiority, or competitive price levels established by others to maximize its profits; unregulated suppliers can do just that. Moreover, if Western Electric were unaffiliated, it could pursue a practice like that described by an ITT witness in FCC Docket No. 19129, consisting of charging more for central office additions where the telephone company is locked in than for more competitive, new office sales—"like selling the razor and then selling the razor blades" (Tr. 19743).

Western Electric's price performance rests on a high rate of productivity improvement. Its average annual improvement in total factor productivity (output per unit of labor and capital) on Bell System business during the period 1967-1976 has been approximately 3.8 percent, or about 46 percent greater than the annual improvement for the electrical equipment industry and more than three times that of the private domestic economy and more than double that of the manufacturing sector (see Attachment H). Such productivity gain, in addition to helping to keep prices down, is the source of improvement in the real incomes of the

American people.

Western Electric's price and productivity performance could only have been realized through efficient management. McKinsey and Company, Inc., a well-known management consulting firm, conducted a comprehensive and in-depth survey of Western Electric's operations over a two-year period. They concluded, with respect to Western Electric's and outsiders' prices, that the "price differentials are too large to be explained in terms of Western Electric's volume alone." [A Study of Western Electric's Performance (1969), (p. 23)]. "This advantage is, in our opinion, due to unusually good manufacturing management and the cumulative results of the company's continuing cost-reduction program" (p. 25). In addition, McKinsey's overall conclusions included:

Our extensive analysis of Western Electric's operating results since 1950 provides convincing evidence that the company has been very efficiently managed (p. xiv).

McKinsey's conclusion was echoed by the Touche Ross firm in its report to the FCC in Docket 19129:

Western Electric, overall, is an efficient organization and makes good use of manpower, systems, equipment and corporate relationships in terms of producing goods and providing services according to specification, in sufficient quantity, at the time required, at minimum cost . . . (ALJ Ex. 1, p. 3).

The FCC concluded that "Western has quality management and has generally performed efficiently overall . . ." (FD para. 55).

Western Electric's prices are based upon a highly sophisticated and detailed standard cost accounting system. McKinsey & Co., in its Study of Western Electric's Performance, noted its "well-developed cost measuring and control system." The Touche Ross accounting firm in its report to the FCC in Docket 19129 stated:

In our opinion Western Electric's cost accounting practices are reasonable and consistently applied (ALJ Ex. 1, p. 113).

The Arthur Young and Company accounting firm annually certifies the substance of the following (the precise language is from the 1977 certification):

. . . the accounting procedures of Western Electric Company, Incorporated comply with the requirements stated in the Final Judgment of the United States District Court in Civil Action No. 17-49 ordering Western Electric Company, Incorporated "to maintain cost accounting methods that conform with such accounting principles as may be generally accepted and that afford a valid basis, taking into account the magnitude and complexity of the manufacturing operations involved, for determining the cost to Western of equipment sold to AT&T and Bell Operating Companies for use by them in furnishing common carrier communications services."

Western Electric's financial results and its cost accounting procedures are monitored by and reported annually to a joint NARUC-FCC committee which has ongoing regulatory oversight responsibility to determine the reasonableness of Western Electric's costs and prices.

If, and to the extent that Section 333 rests on fear of cross-subsidization among various Western Electric products, divestiture is a drastically excessive and unnecessary remedy. The cost accounting principles and practices applicable to manufacturers are well developed, and Western Electric follows them. There are relatively few common costs in manufacturing operations. Because Western Electric's prices are based on costs, we do not believe that there is any cross-subsidization between Western Electric's products. Regulation has controlled and can prevent any feared cross-subsidization in Western Electric's prices without complex litigation over costing methodologies and auditing procedures.

The cost and price performance of Western Electric rests significantly on the economies of scale and maximum opportunities for economies and cost reduction offered by technological integration.

In addition to reasonable prices, Western Electric's profits also have been reasonable. As shown in Attachment I, Western Electric's return on net investment has averaged 9.1 percent in the 1968-1977 period, while the comparable figures for the 50 largest manufacturers and

Moody's 125 industrials are 12.1 percent and 11.8 percent, respectively. A divested, unregulated Western Electric would be able to achieve significantly higher levels of earnings than has the integrated organization.

The advantages of the Bell System's integrated structure from the point of view of a Bell Operating Telephone Company will be described for you by Mr. Marshall. The Long Lines perspective will be provided by Mr. Sageman. These advantages have been recognized by authorities in Great Britain, where such integration does not exist, and Sweden, where it does. A Select Committee of the British Parliament criticized the existing division of responsibility for R&D efforts between the British Post Office and its telephone equipment suppliers. The Select Committee underscored the importance of "associating research work as closely as possible with the operation of the equipment developed" and added:

They (the Committee) note the advantages obtained within the Bell System in America, where the research work of Bell Laboratories is closely coordinated with the production requirements of the Western Electric manufacturing company but where both are completely under the same ownership and control as the operating companies.

– 1st Report, Select Committee on Nationalized Industries, "The Post Office," Vol. I, Feb. 24, 1967, pp. 161-162.

The same point in favor of integration was made about the role of Teli, the manufacturing arm of the Swedish Telecommunications Administration:

As an internal unit within the Telecommunications Administration Teli constitutes a natural link in the cooperation chain marketing function–development function–manufacturing function–distribution function. Teli is able to make long-term plans because at an early stage it learns the intentions of Marketing Department, Telephones (F) regarding future products and market requirements. Through cooperation with the Technical Department (U) Teli can affect the product design at an early stage, so that it is suitable for manufacture right from the start. The cooperation with the Materials Division (M) means that Teli has access to the Administration's prognoses and can carry out a dialogue regarding the build-up of stores in the manufacturing or distribution stage. I am convinced that only through constructive cooperation can these units achieve the best possible result for the Telecommunications Administration and the telephone subscribers.

– Kai Lervik, Head of Industrial Division (Teli), Swedish Telecommunications Administration, "Investing in Teli," TELE, 2/1977, p. 58.

THE ALTERNATIVES TO THE BELL SYSTEM'S INTEGRATION ARE MUCH LESS ATTRACTIVE

Given the unique complexity and size of the telecommunications network and the special relationships between designer, manufacturer and operator which are required to serve current and future needs most effectively, the question that must be answered is whether the structure of the Bell System is necessary and in the public interest. Comparison with other systems provides useful evidence on this crucial question.

Government Procurement of Weapons Systems

Within our own national economic structure, one of the closest comparisons can be found in the area of national defense. While the telecommunications network is the most complex technological system in the world, major military systems are large, very complex and require substantial research and development in areas of high technology. The problems and deficiencies in the defense procurement process have been a source of Congressional concern for many years. Cost overruns are well documented, as are Congressional findings on the temptations for government contractors to inflate target costs under incentive contracts and to inflate actual costs in order to maximize profits on follow-on procurements. (Report on the C5A Program, Subcommittee on Economy in Government, Joint Economic Committee, May 1969.) It is of significance that former Secretary of Defense

Laird attributed most of the government's procurement difficulties to problems in formulating workable specifications and to the problems occurring during the transition from development to production (Testimony of former Secretary Laird before the Senate Appropriations Subcommittee, June 10, 1969.), areas in which the Bell System's integrated structure has afforded considerable advantages.

In connection with its study of the Bell System's vertical integration, the staff of President Johnson's Task Force on Communications Policy considered the defense procurement model. That group noted that:

. . . whatever correlation the contractor perceives between long-run business prospects and his ability to control costs seems to be overridden by the temptations of a cost-plus contract and the dominant incentive to perform well and on time (Staff Paper No. 5, p. 187).

Strikingly, the Staff Paper suggests that the telecommunications carriers, if forced to operate under the Department of Defense model of procurement of complex systems, would be even less successful than the government itself, because of the interactiveness of the telephone network and the constant change in system design.

To the extent that the telecommunications network differs from aerospace systems, contractual relationships between the carrier and its suppliers are likely to become even less successful at controlling development costs . . . So long as equipment was subject to such changing specifications throughout its lifetime in service, the carrier would frequently have to give up the cost discipline of a fixed-price production contract to seek design changes on a cost-reimbursement basis (Staff Paper No. 5, pp. 184-185).

While my point is that one alternative to Bell's integrated structure would be a procurement system for the telephone companies like that used by the military—with all of its demonstrated problems—some might suggest that the answer is a more competitive system for the government and, by analogy, for the telephone companies. Paul C. Warnke, at the time General Counsel of the Department of Defense, pointed out to the National Industrial Conference Board the impracticality of such an approach for defense systems:

But this (competitive) ideal is, I fear, impractical in dealing with highly complex and sophisticated weapons systems that represent major advances in the state of the art. For such systems, the creation of the multiplicity of choice would greatly increase the defense budget and could significantly delay the acquisition of the new arms we need. I recognize that it approaches heresy to say that competition ever may not be worth what it costs. But in this field, I think we would all agree that the price would be to high.

— "Competition, Antitrust and National Defense," address to the N.I.C.B., March 2, 1967, p. 53

I do not recite this history to disparage the dedicated and highly competent efforts of the Department of Defense and their many contractors—including the Bell System—in providing our country's highly effective defense systems. I do suggest, however, that if forced to operate in a similar mode the Bell System would encounter similar and, in fact, more intractable problems. Particularly in an area of broad public service where the economics are even more demanding than in the area of national defense, I ask that the Congress consider whether the alleged and unproven benefits of the destruction of the Bell System's technological integration is worth the price that the evidence suggests would have to be paid.

The Telephone Systems of Other Countries

Although the telephone network of the United States is significantly larger and more advanced than those of other countries, the problems that other telephone administrations face are not basically different from our own. They have approached the solution to these problems in a variety of ways, some closely similar to the Bell System and others substan-

tially different. As I mentioned earlier, Sweden and the industrialized eastern provinces of Canada are served by organizations with technologically integrated structures similar to that of the Bell System. And—I believe not coincidentally—the service they offer is among the best outside of the United States. The Japanese are also building a first-class telephone and data communications system. They have developed a form of *de facto* integration of a selected group of suppliers and the Japanese telephone administration (NTT). NTT operates major R&D laboratories and engages in cooperative development with selected suppliers. By means of allocation of NTT's requirements, those manufacturers are directed as to which products to make for use by the telephone system. The Japanese have developed a cooperative relationship between their telephone administration and their manufacturing industries, a relationship that may perhaps be possible only in Japan.

In Western Europe, the part of the world (outside of Canada) most comparable to the United States, the government-owned telephone systems purchase their equipment from selected private companies, again by complex allocation procedures. The level of telephone service in Europe is noticeably below that in this country, although major expenditures have been made for research and development.

Other Utilities

The electric and gas utility industries in this country offer another organizational structure that can be compared with the integrated Bell System. For many years the electric power industry had depended on its equipment suppliers for R&D. Following the 1965 blackout in the Northeast, legislation was introduced in Congress to establish a federal agency to do the R&D work for the industry. Moreover, within the electric power industry itself, concern had been expressed regarding the inadequacy of the R&D programs of the suppliers of electric power equipment and the lack of coordination and direction by the electric utilities themselves. In 1972, the electric industry created EPRI, the Electric Power Research Institute, a not-for-profit research organization financed by contributions from its members, the electric utilities.

A somewhat similar history of dissatisfaction with R&D in the natural gas industry led to the creation in 1976 of the Gas Research Institute (GRI).

The creation of EPRI, which had been encouraged by Congress and the National Association of Regulatory Utility Commissioners (NARUC), can be viewed as a first step in the direction of integrating the planning and control of technology in the electric power industry similar to that which has been so effectively achieved through complete technological integration in the Bell System. It is ironic that in the face of this Congressional concern and the need for integration which Congress and the electric power industry have recognized, that Section 333 would move the Bell System in the very opposite direction.

By way of conclusion, it can safely be said that the Bell System's structure, and the innovation and procurement arrangements that stem from it, compare favorably with whatever alternative systems can be studied. Others faced with similar problems have concluded that more—not less—integration is the answer.

Outstanding Experts Have Supported Bell's Vertical Integration

Over the years renowned economists, scientists, regulators and observers of the public utility scene have examined the Bell System structure and the overwhelming weight of opinion is that the Bell System's integrated structure should be retained, that its high level of performance merits emulation elsewhere, and that dismembering the Bell System would be seriously detrimental to the public interest. The opinions of various authorities are set forth in Attachment J.

ADVERSE EFFECTS OF DIVESTITURE

The loss of the advantages of technological integration in telecommunications constitutes the major disadvantage of disintegration. In addition, however, there are other consequences that the Congress should consider.

Impaired Responsiveness to Local and National Emergencies

The telecommunications network has become an essential part of our everyday economic and social life. The rare failures of service, most often the result of severe storms, remind us that it is especially in times of such emergencies that the restoration of telecommunications service is critical to support other vital functions. The structure of the Bell System has been designed with that requirement in view. Standardization of equipment and procedures makes it possible to divert equipment and trained personnel from other areas to assist in the restoration of services. We can lay first claim to the talents of the designers of the network to provide unusual configurations on a temporary basis. Most importantly, we can instantaneously commandeer the widespread resources of Western Electric's manufacturing and installation forces and direct their sole attention to the affected region of the country.

Without this capability, substantial stockpiles of emergency supplies would be required at all times—with the attendant costs and gradual obsolescence of equipment. However, I cannot envision any way in which comparable responsiveness could be obtained.

Attachment K contains more details on just three of many possible illustrations of Bell System responsiveness during emergencies.

Disruption of a Major National Resource

Congress should be aware that the divestiture of Western Electric would also require a fragmentation of Bell Laboratories, and that such fragmentation would effectively destroy the structure in which Bell Laboratories has made its important contributions. As I have pointed out, Western Electric does not possess a product design organization but depends upon a major part of Bell Laboratories for that function. Presumably, a major portion of Bell Laboratories would be divested with Western Electric to allow Western Electric to be a viable supplier of modern telecommunications equipment. At the same time, the parts of Bell Laboratories that might remain within the Bell System would lose their capability for product design and knowledge of manufacturing process, which, as I have said, is so important to the research and systems engineering functions.

In addition to the extreme effect that this fragmentation of Bell Laboratories would have on telecommunications and the Bell System and its customers, it would also represent the dissipation of a major national resource. The contributions of Bell Laboratories have extended far beyond telecommunications itself. The invention of the transistor and solid state electronics formed the basis for our entire electronics industry. The contributions to electronic logic and information theory are a cornerstone of the computer industry.

As I said earlier, Bell Laboratories and Western Electric have, on many occasions, served the nation's interests in areas outside of telecommunications. Following World War II, Bell Laboratories and Western Electric were called upon to establish Sandia Laboratories to manage the nation's effort in atomic weaponry. The same team has been a major contributor to the nation's air and underwater defense systems. During the Apollo manned space program, at the request of NASA, AT&T established its Bellcomm subsidiary, using resources of Bell Laboratories and Western Electric in order to provide systems engineering support for the program.

The Congress should be conscious that

this resource would be drastically fragmented by the provision of Section 333. This would occur at a time when the nation is concerned about its leadership in technological innovation. There is deep concern about the current concentration by U.S. industry on short-run and defensive R&D, under which true innovation is sacrificed to the greater likelihood of near-term returns (e.g., *Business Week*, 7/3/78). The implications of this reported decline in industrial research have led the President to order a major 28-agency review of government policies regarding innovation. The reason for Presidential concern is highlighted by a 1977 Commerce Department report that technological innovation was responsible for 45 percent of the nation's economic growth from 1929 to 1969.

In contrast, the productive research and development performance of the Bell System arises out of a continuing commitment of significant resources to that activity. The Bell Laboratories budget for 1978 is about $900 million and has been increasing year after year. The commitment to basic research and innovation remains high. Basic research at Bell Laboratories constitutes about 13 percent of the total budget and has remained very stable from year to year.

Looked at from the Western Electric perspective—and on a National Science Foundation definitional basis which permits comparisons with other industries—Western Electric spent 6.6 percent of its Bell sales on R&D annually during the period 1966-1975. This compares with company-financed R&D expenditures of 2.0 percent of total sales for all manufacturing industries, and 3.5 percent for the communications and electronic equipment industry, excluding Western Electric (See Attachment L).

During the year 1977, Western Electric funded $653 million for development and related engineering of new and improved products for the Bell System. Over the last ten years, 1968-1977, a total of $4.91 billion was spent for this purpose. Those figures do not include R&D on government work, nor do they include the related activities at Bell Laboratories that are funded directly by AT&T.

Harmful Effects on the United States Position in International Trade

Prior to the 1920s, the Bell System and Western Electric were major factors in providing telecommunications equipment abroad. During the 1920s, Western Electric divested itself of most of its international manufacturing activities and concentrated its resources on supplying the Bell System in the United States.

A few years ago, at the request of the government of Iran and with the encouragement of the U.S. government, AT&T established American Bell International, Incorporated (ABII), which is providing the principal systems engineering and planning effort for a major expansion of the telecommunications system in Iran. ABII has been staffed primarily by employees of Bell Laboratories, Western Electric and the Operating Telephone Companies.

More recently, Western Electric has established an international subsidiary which is actively soliciting business, especially among the developing countries in the Middle East. In collaboration with other U.S. suppliers, a $500 million project for a microwave transmission network is underway in Saudi Arabia. Other major proposals are in various stages of negotiation.

These international activities make positive contributions to the well-being of developing nations and to the U.S. balance of trade. Congress should also consider the effect upon U.S. imports of disrupting our country's primary source of telecommunication equipment and innovation, and the implications of such disruption for our citizens. It is generally recognized that the other industrial nations of the world purchase telecommunications equipment and systems from their national manufacturers who, in turn, use this as a base for sales in other parts of the world. Many equipment suppliers in the United States depend upon foreign

sources for equipment designs and, often, for the equipment itself. Japan, Sweden and Canada, which have integrated R&D, manufacturing, and operations, have been particularly successful in selling their equipment in the United States. I recommend that the Congress carefully consider the implications for international trade and domestic employment as you ponder the possible consequences of Section 333.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of my testimony has been to demonstrate the benefits of a vertically and technologically integrated structure in telecommunications, as well as the profoundly negative consequences for the nation if Section 333 of the Communications Act of 1978 were enacted. Those consequences include a serious impairment of technical innovation in telecommunications which would substantially and adversely affect the quality, variety and cost of telecommunications service in the future. Enactment of Section 333 would also irreparably disrupt a system of technological innovation that has made major contributions to American industry; its passage would jeopardize our country's competitive position in world markets and our national security and prosperity. Those risks are proposed even though a factual case has not been made to the Congress of the need for Section 333, nor has there been any recommendation for such changes in the Bell System's structure by the FCC, the regulatory agency chartered by Congress to oversee the industry.

There is no dispute that the telephone system in this country is the best in the world. Today, more than 90 percent of American households have telephone service. The quality of that service is excellent. For example, the likelihood of getting through to the right number, if correctly dialed, on the first attempt is high—over 99 percent. The communication paths themselves are of high quality, with low noise and good fidelity, and new transmission systems and improved operating procedures are constantly being developed to make service even better. In the past inflationary period telephone rates have gone up far less than the price of most other goods and services. For example, since 1967, Bell System telephone rates generally are up an average of only 38 percent and long distance rates are up only 21 percent, while the Consumer Price Index has increased 82 percent (Attachment M). The FCC, in its decision in Docket 19129, found that "the overall performance of the Bell System has been, and continues to be excellent, generally providing high quality telephone service at reasonable rates . . ." (FD para. 32).

The innovative record of the Bell System in telecommunications is without parallel. Bell Laboratories scientists and engineers have been awarded over 18,000 patents, five Nobel Prizes and many other major awards for contributions to science and technology—a record unmatched by any industrial laboratory in the world. Across the spectrum of telecommunications, Bell Laboratories is the recognized leader.

Western Electric's performance record also is outstanding. As previously mentioned, Western Electric's prices for telecommunications products average about 20 percent below those available from the lowest general trade supplier and are generally of superior quality and function. Western Electric's annual improvement in productivity has been more than twice that of the manufacturing sector of our economy and well above that of its own industry.

It is essential to recognize that Western Electric is not an independent, readily separable manufacturer. It is a critical link in that process of technological innovation that includes Bell Laboratories, AT&T, and the Operating Telephone Companies. The divestiture of Western Electric would break that chain. It would destroy the necessarily close interaction between the innovator, the implementer, and the operator of the technology upon which our telecommunications system is

based. The result would be a serious impairment of the ability of the Bell System to introduce new technology to improve service and reduce cost.

The disruption of Bell Laboratories that would inevitably result from the divestiture of Western Electric would have adverse effects for the country beyond those relating to the telephone industry. Bell Laboratories is a national resource, making significant contributions to national security and to the growth of industries other than telephony. From its early work on radar, aircraft and missile defense, through its current work on secure communications and underwater sound systems for surface vessel and submarine detection, Bell Laboratories' preeminence in electronics and communications technology has been used by our government to strengthen America's military security in war and in peace. From the early days of radio and "talking pictures," through the invention of the transistor and the basic laser patent, Bell Laboratories' innovations have created major industries which, in themselves, are important contributors to the nation's prosperity and technological leadership.

Those contributions to national security and economic well-being arose out of the Bell System's technologically integrated structure. After the divestiture of Western Electric called for by Section 333, the fragmented Bell System would not have the capability to serve the national interest as well in the future as the integrated organization has in the past.

The Bell System structure has been repeatedly studied, and many experts have counseled against fragmenting it. Among those studies is that of President Johnson's Task Force on Communications Policy in the United States. Staff Paper 5 of that Task Force, published in 1969, concluded that "the case for a carrier-manufacturer tie is at its strongest in telecommunications" (p. 193).

Professor (now CAB Chairman) Alfred E. Kahn, a noted proponent of increased competition in industries presently regulated, is one of the scholars who has rejected divestiture of Western Electric. In his 1971 treatise, *The Economics of Regulation*, he wrote:

This writer would find it extremely difficult himself, in the face of the objective record of good performance and the qualitative arguments that provide at least a highly plausible basis for attributing those results in important measure to vertical integration, to recommend the plunge into the unknown. (Vol. 2, p. 305)

And he repeated that advice against divestiture to this Subcommittee in 1976 (*Hearings on Competition in The Telecommunications Industry*).

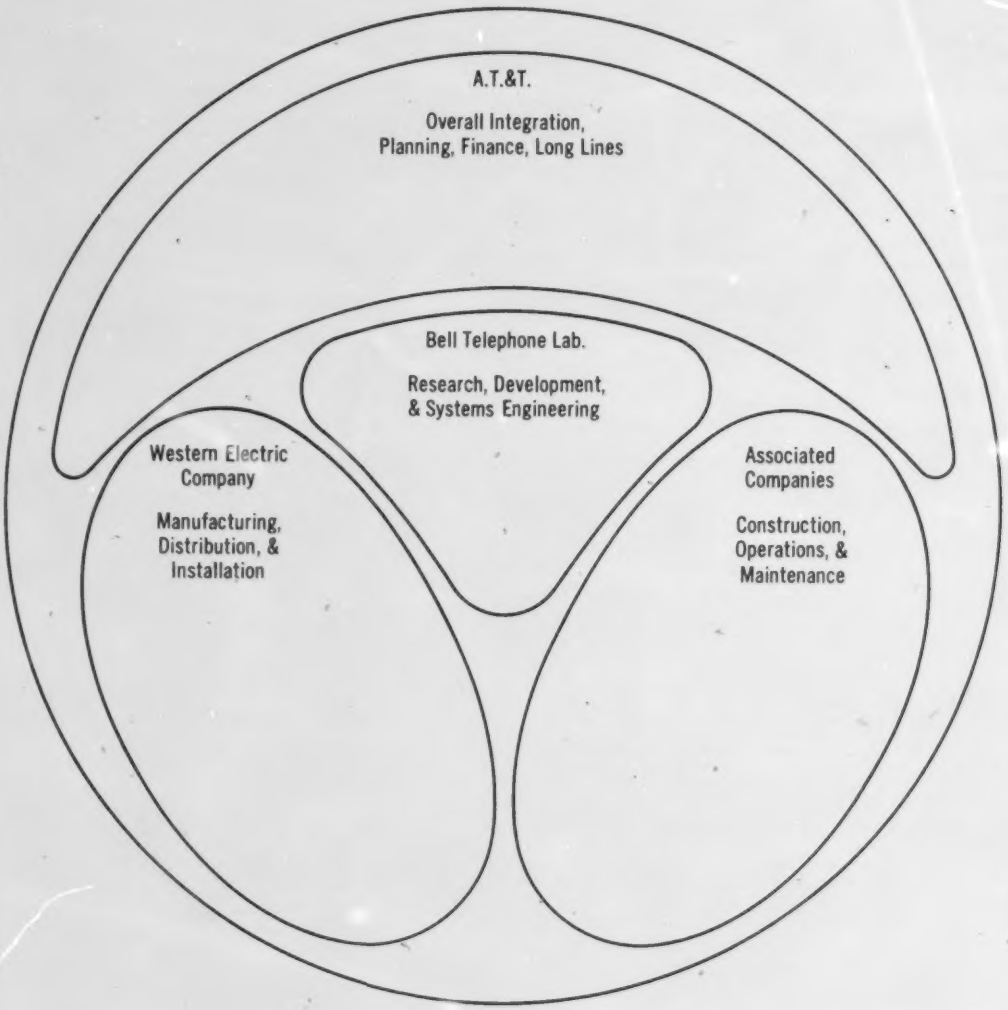
The nature of this integration, this vertical integration, is almost unique in American industry in the physical, technological character of it.

When an oil company has operations in production and in pipelines and in refining, there is virtually no connection between the two except a financial one. The technologies are totally different. The same thing with cement, steel, and aluminum.

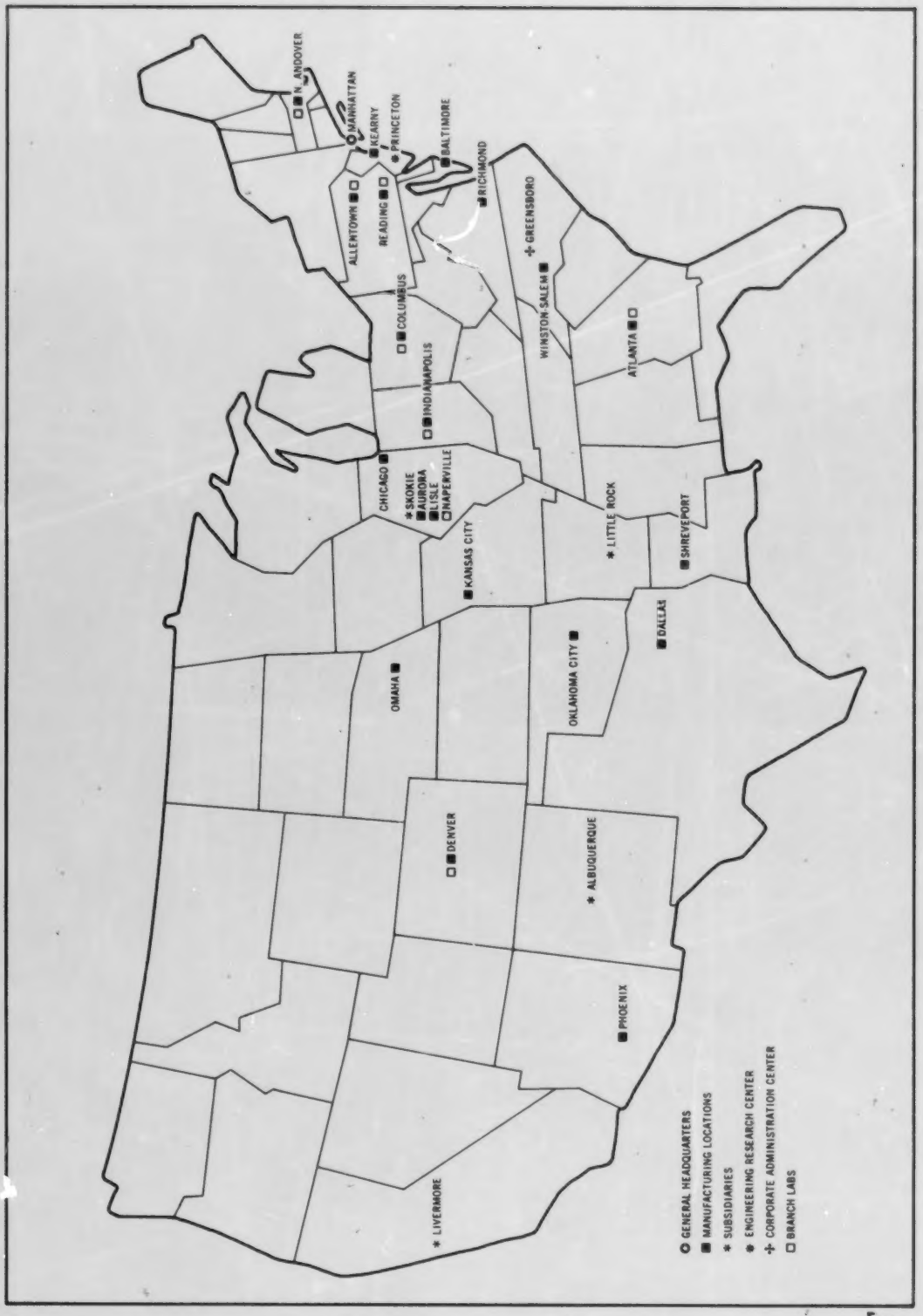
Here there does seem to be a very intimate technological collaboration with this sort of three-sided group of Western Electric, Bell Labs, and the telephone companies, which makes me very reluctant to take that course. (p. 1023)

In light of the Bell System's performance record and the repeated recognition over the years of the benefits flowing from its technologically integrated structure, the structure of the Bell System is a matter of national concern. It impacts the infrastructure of our society and has ramifications for prosperity, employment, national defense and this country's position in the world. I repeat Mr. Ellinghaus' recommendation that responsibility for deciding whether that structure serves the national interest rests with the Congress, not the FCC or the proposed Communications Regulatory Commission and not with the courts. Accordingly, I urge that the Congress provide for a thorough examination of the values of the present structure of the Bell System. It is my own conviction that based on such an examination you will conclude, as I have, that the present structure has operated and continues to operate in the public interest and that Section 333 should be deleted.

BASIC ELEMENTS OF THE BELL SYSTEM *ATTACHMENT A*



ATTACHMENT B


N. ANDOVER
MANHATTAN
KEARNY
PRINCETON
BALTIMORE
RICHMOND
ALLENTOWN
READING
GREENSBORO
COLUMBUS
WINSTON-SALEM
INDIANAPOLIS
ATLANTA
CHICAGO
SKOKIE
AURORA
LISLE
NAPERVILLE
KANSAS CITY
LITTLE ROCK
SHREVEPORT
DALLAS
OMAHA
OKLAHOMA CITY
DENVER
ALBUQUERQUE
PHOENIX
LIVERMORE
GENERAL HEADQUARTERS
MANUFACTURING LOCATIONS
SUBSIDIARIES
ENGINEERING RESEARCH CENTER
CORPORATE ADMINISTRATION CENTER
BRANCH LABS

WESTERN ELECTRIC MANUFACTURING LOCATIONS *ATTACHMENT D*

	Principal Products
1. Allentown Works (Allentown, Pa.)	Hybrid and digital integrated circuits, ferrite and semi-conductor memory devices, microprocessors
2. Atlanta Works (Norcross, Ga.)	PIC and pulp exchange cable, vinyl cable, associated apparatus.
3. Baltimore Works (Baltimore, Md.)	Exchange, toll, and coaxial cable, cords, aerial cable terminals, connectors, protectors, connecting blocks.
4. Columbus Works (Columbus, Ohio)	Step-by-Step Frames—Units and Common Systems, Crossbar Equipment and Apparatus, traffic service position system frames.
5. Dallas Works (Mesquite, Texas)	No. 1 ESS equipment and apparatus, ferrod sensors, ferreed switches.
6. Denver Works (Denver, Colo.)	Dimension PBX and associated equipment, 770A PBX, 400 Switching System.
7. Hawthorne Works (Chicago, Ill.)	Metals and alloys, power and panel equipment, common systems, main interconnecting frames.
8. Indianapolis Works (Indianapolis, Ind.)	Trimline telephones, Touch-a-matic telephones, Design Line telephones, operator headsets.
9. Kansas City Works (Lee's Summit, Mo.)	Microwave radio carrier systems, voice and carrier repeaters, hybrid integrated networks.
10. Kearny Works (Kearny, N.J.)	Key telephone equipment, power equipment, relays, connectors, printed wiring boards, jacks and keys, submarine cable repeaters.
11. Merrimack Valley Works (North Andover, Mass.)	Cable carrier terminals, coaxial cable carrier systems, digital channel banks, digital data equipment, magnetic and quartz crystal components.
12. Montgomery Works (Aurora, Ill.)	Data sets and associated equipment, message unit recording and billing systems, components.
13. North Carolina Works (Winston-Salem, N.C.) (Burlington, N.C.)	Carrier multiplex equipment, inband signaling equipment, voice and telegraph repeaters, components.
14. Northern Illinois Works (Lisle, Ill.)	No. 4 ESS equipment, hybrid integrated circuits, mini-trunks, processors.
15. Oklahoma City Works (Oklahoma City, Okla.)	Regular No. 2 and No. 3 ESS equipment, remreed switches and frames, Automatic Intercept System, 3A Processor.
16. Omaha Works (Omaha, Neb.)	PIC and PVC cable, wire, wire spring relays, miscellaneous central office equipment.
17. Phoenix Works (Phoenix, Ariz.)	PIC and pulp exchange cable, PVC cable, custom cables.

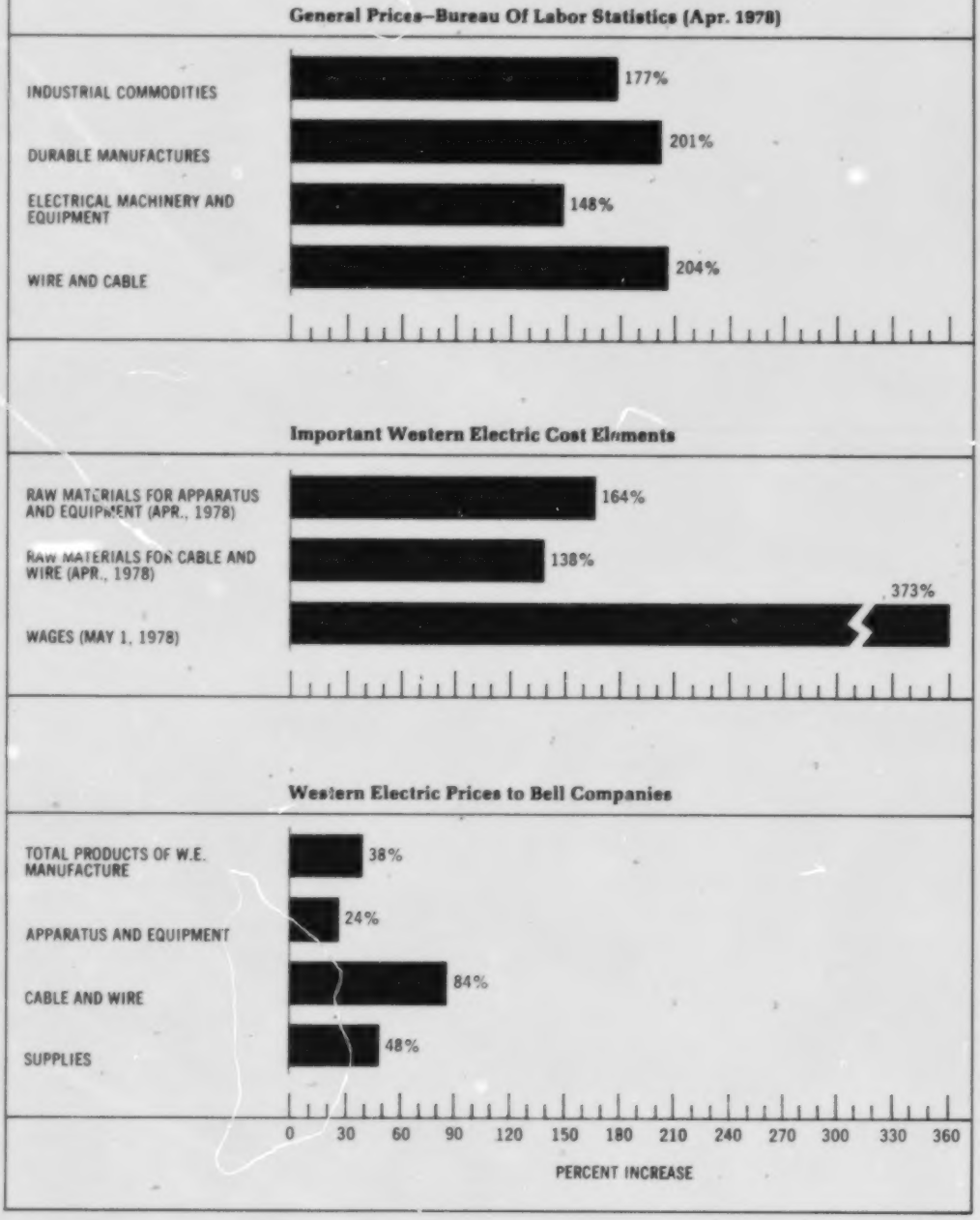
ATTACHMENT D (Continued)

18. Reading Works (Reading, Pa.)	Semi-conductor components, linear integrated circuits, light emitting diodes, traveling wave tubes.
19. Richmond Works (Richmond, Va.)	Flexible and multi-layer printed circuit boards, bonded board assemblies.
20. Shreveport Works (Shreveport, La.)	Regular desk and wall telephones, Princess telephones, coin operated telephones, various console telephones, installer's handsets.

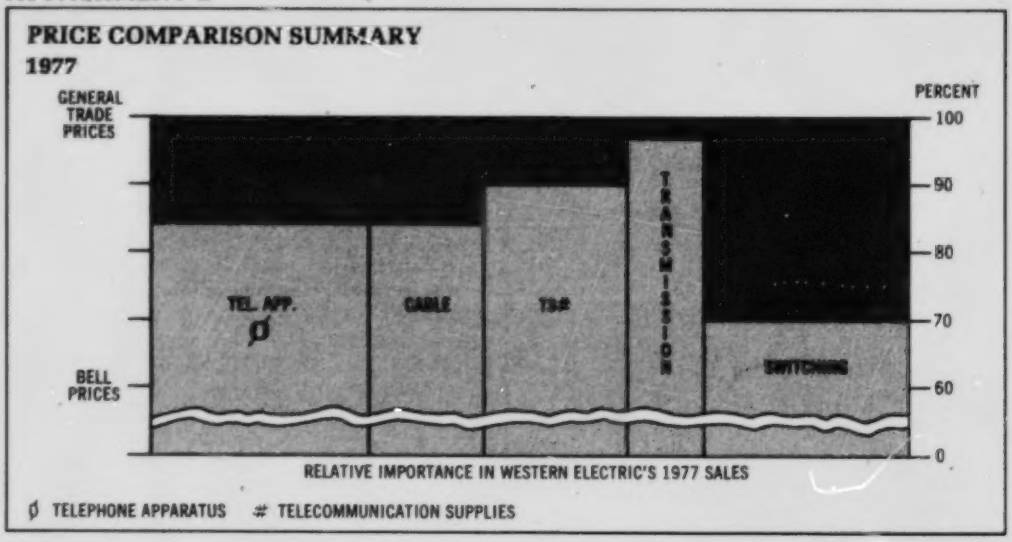
SEATTLE
PORTLAND
PACIFIC REGION
SUNSET-WHITNEY
SAN FRANCISCO
SUNNYVALE
LOS ANGELES
PHOENIX
SALT LAKE CITY
MOUNTAIN-NORTHWESTERN REGION
DENVER
AURORA
SOUTHWESTERN REGION
DALLAS
HOUSTON
MINNEAPOLIS
DES MOINES
UNDERWOOD
OMAHA
KANSAS CITY
GODDARD
MILWAUKEE
ROLLING MEADOWS
CHICAGO
MILES
DETROIT
CLEVELAND
COLUMBUS
DUBLIN
INDIANAPOLIS
SPRINGFIELD
CINCINNATI
CENTRAL REGION
BALLWIN
NASHVILLE
JACKSON
ALEXANDRIA
NEW ORLEANS
SOUTHERN REGION
BIRMINGHAM
MONTGOMERY
ATLANTA
COLUMBIA
CHARLOTTE
GREENSBORO
GASTON
JACKSONVILLE
MIAMI
EASTERN REGION
MARTINSBURG
RICHMOND
WASHINGTON
TOWSON
PITTSBURGH
PHILADELPHIA
COCKEYSVILLE
MORRIS TOWNSHIP
SUFFERN
SYRACUSE
NORTHEASTERN REGION
BOSTON
ORANGE
LONG ISLAND
QUEENS
MANHATTAN
STATEN ISLAND
NEWARK
UNION
PRINCETON
GENERAL HEADQUARTERS
SERVICE CENTERS
DISTRIBUTION CENTERS
MATERIAL MANAGEMENT CENTERS
INSTALLATION AREA OFFICES
REGION HEADQUARTERS
SUBSIDIARIES
CORPORATE EDUCATION CENTER
BELL SALES DIVISION TRAINING CENTER
COMMUNICATIONS PRODUCTS CENTER
GUILFORD CENTER
CORPORATE ADMINISTRATION
GOVERNMENT SYSTEMS
WESTERN ELECTRIC INTERNATIONAL
SOUTHGATE OFFICE BUILDING OPERATING VICE PRESIDENTS

ATTACHMENT F

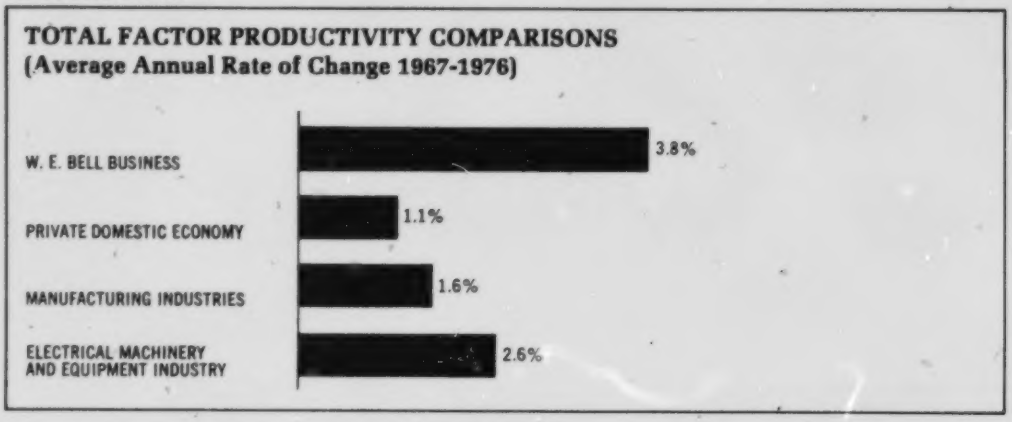
COST AND PRICE COMPARISONS
May 1, 1978 With January 1, 1950 Levels



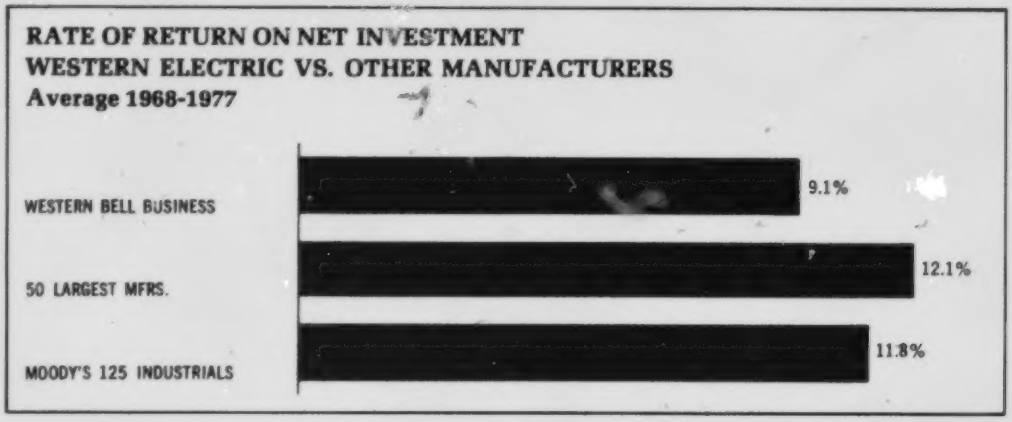
ATTACHMENT G



ATTACHMENT H



ATTACHMENT I



ATTACHMENT J

WHAT OTHERS HAVE SAID ABOUT THE BELL SYSTEM'S INTEGRATED STRUCTURE AND PERFORMANCE

Dr. Otto Eckstein, Professor of Economics, Harvard University and former member of President Johnson's Council of Economic Advisers, in filed testimony in FCC Docket 19129, (Bell Ex. 45) (1974) (p. 45)

"...the present method of procuring equipment of the Bell System through the Western Electric relationship has performed well compared to the other known systems that can be studied. There is no way of telling with certainty whether the present arrangement was necessary to Western Electric's superior performance relative to its industry and other sectors of the economy or whether the ingenuity of man could not devise an equally effective or perhaps even better system. But, based on the performance record, the present Bell-Western arrangement looks pretty good compared to the alternatives."

Eugene V. Rostow, Sterling Professor, Law and Public Affairs, Yale University, in testimony before the Subcommittee on Antitrust and Monopoly of the Senate Committee on the Judiciary (July 30, 1974) (pp. 45-46)

"Rather, we found it (the structure of AT&T) to be a reasonable and indeed an inevitable system for organizing the kind of inputs which are indispensable to the process of maintaining and improving an integrated national and international system of communications—research inputs; engineering inputs; manufacturing inputs; and the inputs of overall management. The pattern which the Bell System has developed for the conduct of that process strikes me as an efficient and effective way to bring all these perspectives to bear on an infinitely complex problem. I see no reason to subject that organism to radical surgery.

On the contrary, on this basic and ultimate issue raised by the application of the Hart Bill to the Bell System—the value to our economy of maintaining the integrated communications network as a viable entity, and allowing Western Electric, the Bell Laboratories, and the Bell System operating companies to work together in developing, maintaining, and improving it—it seems to me that a reorganization of the communication equipment industry along the lines prescribed by the Bill would be a disaster—and a disaster without compensating advantages."

Alfred E. Kahn, Chairman of the CAB, distinguished economist and former Chairman of the N.Y. Public Service Commission, in *The Economics of Regulation:*

Principles and Institutions, Vol. 2 (1971) (p. 305)

"... the essence of the case for competition is that the potential performance of an industry is unknowable; it is the rivalry of independent suppliers that offers the greatest possible assurance that all economically feasible avenues for cost reduction and service innovation will in fact be explored and their results subjected to the impartial test of the marketplace.

This is not, however, a sufficient guide to public policy in all times and places, as the institution of regulated public utility monopoly itself indicates. It remains possible that the manufacture of equipment for the central core of the natural monopoly, the communications network, is a "natural" part of that monopoly. This writer would find it extremely difficult himself, in the face of the objective record of good performance and the qualitative arguments that provide at least a highly plausible basis for attributing those results in important measure to vertical integration, to recommend the plunge into the unknown."

Howard W. Johnson, Chairman of the Corporation, Massachusetts Institute of Technology, in testimony before the Subcommittee on Antitrust and Monopoly of the Senate Committee on the Judiciary (July 31, 1974) (p. 7)

"I concluded on the basis of these 'input and output' measurements that there were decided system advantages to the operation of the Bell System and its three component structures as it stands. It is performing exceedingly well.

The question remains would it perform as well with either or both of the laboratories or Western Electric divested. We cannot know the answer for certain. There are no models outside the country that provide guidance in the affirmative. All indications are that the present system performs exceedingly well at the level of the relationship I have described. I conclude that it would be risky in the public interest to experiment with divestment. Once broken, the system would not be easily rejoined."

Robert R. Nathan, President of Robert R. Nathan Assoc., Inc., Consulting Economists, in testimony before the Subcommittee on Antitrust and Monopoly of the Senate Committee on the Judiciary (June 20, 1974) (pp. 13-14)

"For an economist, it would be possible, if we were starting from scratch, to construct a hypothetical alternative scenario which would be structurally, functionally, operationally, and economically different from what has evolved, with different relationships between research and development, manufacture, installation, and operations, and different relationships between costs and prices. Whether it would better serve the interests of the nation is problematical. . . . But the point is that we are not starting from scratch. We are starting with the world's best telephone system, and it is in no one's interest—least of all in the public interest—to take it apart functionally or organizationally and risk impairing its usefulness in the doctrinaire search for unprovable improvements."

Robert A. Solo, Professor of Economics, Michigan State University, in *The Political Authority and the Market System* (1974) (pp. 352-353)

"On the face of it, compared to other telephone companies elsewhere or to other industries, its long-run performance, in terms of quality, diversity, and the prices of its services has been quite outstanding; and its contributions to world science and technology, through AT&T Bell Laboratories, has been extraordinary."

"Minuses for size in the dogma of antibigness will not do as a substitute for the systematic evaluation of performance. Nor, as we have seen, is there any reason to rely on a policy of fragmentation to promote creativity and technological advance or to upgrade efficiency or to produce a more equitable distribution of income."

Harvey Brooks, former Dean of Engineering, now Benjamin Pierce Professor of Technology and Public Policy, Harvard University, in "Science Policy in the 70's," *Daedalus*, Vol. 102 (Spring, 1973) (p. 137)

"The Bell System represents the best example of a highly integrated technical structure in a high technology industry and is widely regarded as the most successful and innovative technical organization in the world."

Harvey Brooks, in "The Physical Sciences: Bellwether of Science Policy," *Science and the Evolution of Public Policy* (1973) (p. 114)

"On the industrial side, we face growing problems with environmental protection. These may require drastic modification of such older technologies as paper making, mining, electric-power generation, and the internal combustion engine. Many of these

problems are long-range, and perhaps are beyond the financial capacity or the time horizons of private industry. Their solution may require new forms of governmental intervention, such as taxing the cash flow of major industries to finance environmental or safety research in a centralized way, either directly, through government, or by new types of regulated monopolies analogous to the Bell Laboratories."

C. H. Townes, Professor of Physics, University of California at Berkeley, in "Differentiation and Competition between University and Other Research Laboratories in the United States," *Daedalus*, Vol. 102 (Spring, 1973) (p. 155)

"In the long run, however, the value of research to industry or to the economy as a whole is often overwhelming, especially in industries where techniques and technology can change rapidly. Consider long-distance telephone communications. Between 1935 and 1965, the cost of a long-distance telephone call across the North American continent decreased by a factor of about four in actual dollars. In view of inflation, this was a reduction in real cost by a factor of about twelve, and since 1965 direct dial costs have decreased still further. While some of this cost reduction surely resulted from increased use of the telephone, much of it derived from research and development, some of it quite basic. A very large fraction of the applicable research and development took place in the Bell Telephone Laboratories, the dominant communications laboratory in the United States, a fact which enables one to specify its character and cost with some surety. The yearly bill in 1965 for all long-distance telephone calls in the United States was about $4 billion. With the knowledge and technology available in the mid-30's, the same service would probably have cost $25 billion dollars or more. For such service, present technology thus saves the American public many billions of dollars each year. The regulation of rates for the telephone system has also meant that steady reduction in cost of service provided one of the new routes for the company to increase its profits. How much did this research and development cost? The entire telephone system support of the Bell Telephone Laboratories from its beginning in the 1920's until 1965 was somewhat less than $2 billion. Thus, the decrease in cost of services each year is much larger than the total monetary support of the Laboratories over their entire history, and these contributions to long-distance telephone are, of course, only a part of the Laboratories' work."

Dr. Philip H. Abelson, President, Carnegie Institute and Editor of *Science*, at International Meeting on the Organization of Science (1973)

"The Bell Laboratories is a principal research facility of the American Telephone and Telegraph Company. A large number of great basic discoveries has been made there. As an example, solid state physics largely originated there. In the Bell Laboratories scientists and engineers interact very well, scientific discoveries are converted into products, and engineering problems stimulate work leading to discoveries."

Frederic M. Scherer, Professor of Economics, Northwestern University, in *Industrial Market Structure and Economic Performance* (1970) (p. 468)

". . . the plan for breaking off Bell Telephone Laboratories from Western Electric, putting what Fortune called 'the world's greatest industrial laboratory under the wing of A.T.&.T.,' reflected a completely inadequate understanding of industrial research and innovation."

C. Lester Hogan, Vice Chairman (Board) and Director, Fairchild Camera and Instrument Corporation, in "Integrated Circuits and the Electronics Industry," presented at American Physical Society – American Association of Physics Teachers (January 29, 1973) (p. 18)

"Bell has led in the development and use of an incredibly complex infinity of technical developments. It has planned, organized, built, and managed the most extensive and complex electronics system in the world, and has offered to this country the best information handling and communications systems that exist. . . ."

John E. Tilton, Associate Professor of Mineral Economics, Pennsylvania State University, in *International Diffusion of Technology: The Case of Semiconductors*. Washington: The Brookings Institution (1971)

". . . (Tables showing major product innovations) indicate the dominance of American firms during the postwar period in introducing the major semiconductor innovations. Among the American companies, Western Electric, building on the research of Bell Laboratories, has been the leader, although in recent years the share of other American companies has been growing." (p. 18)

". . . Thus, the data on patents, major innovations, and R&D expenditures indicate that

AT&T (including Bell Laboratories and Western Electric) has contributed more to the innovative process and semiconductor technology than any other firm. The number of its patents and of its major innovations greatly exceeds the number of each attributed to other firms, and the amount it spends on R&D in the semiconductor field represents a sizable part of all such expenditures." (p. 63)

World, "The Riddle of Bell Labs" (January 16, 1973)

"Confounding ideologies on both Left and Right, Bell Labs—part of a monopoly—has made some of the most daring technological innovations of the century.

Bell Labs is the only industrial research organization in the world that produces scientific research of such basic importance on a wide scale; finds ways to apply much of it to improving a specific commercial product and services; and has been doing so consistently for almost fifty years.

Bell's performance confounds economic theorists on both Left and Right. Classical capitalist belief insists that product improvement and technological advance are the results of a free market; but Bell is a virtual monopoly. Adversaries insist that capitalist monopolies are technologically reactionary, but Bell innovates more profoundly and more daringly than any of the nationalized industries in Europe, and more and faster than any other American firm that has to meet market competition.

A recent world tour of research laboratories—basic and applied—showed me that where large segments of industry (i.e., communications, transport) were nationalized into large organizations—as in England and France—they did almost no research though they accounted for 50 per cent of their respective national economies. Neither size nor government assurance of a future, I pointed out, were themselves necessary and sufficient conditions for research outputs like Bell Labs. No telephone company, anywhere in the world, has developed along lines as technologically progressive as Bell."

Joseph C. Swidler, former Chairman of the Federal Power Commission and of the New York Public Service Commission in Appendix B to the Report of the Ad Hoc Committee of the NARUC on Energy Research and Development (Nov., 72) (p. 687)

"The great potential advantage of the industry approach is the opportunity for close integration between R&D and the practical operation of the nation's power systems, with the industry managers contributing a flow of problems and research suggestions, the research and development arm responding . . . and receiving a feedback of operating results. While I do not hold out the Bell arrangements as a model for the power industry, I am impressed that the responsiveness of Bell Telephone Laboratories to the research needs of the Bell operating companies finds no parallel in the power industry. In its own way the electric power industry should be seeking an intimate and closely articulated relationship between the research and operating institutions of the industry."

Jervis Langdon, Jr., President & Chief Executive Officer, Penn Central Transportation Co., *The New York Times* (April 1, 1973) Section 3 (p. 14)

. . "Perhaps the time has come for private ownership seriously to consider an organizational structure to preside over the different operating units in the present national railroad system. Possibly, this could be along the lines of the American Telephone and Telegraph Company, or a holding company pattern.

Certainly a central control would bring order out of the present confusion; give a sense of direction to the individual railroad, and bring them together in providing better transportation service for the entire country. It should also stop the interminable quarreling and eliminate the staggering expense that inevitably arises when railroads are forced to deal with each other.

More importantly, central control (in whatever form attainable) would give the country the great advantages of a rail system that operated as a true system. The public would have the use of the most efficient routes without regard to interchange points and car supply would be geared to national needs and not be limited by the financial ability of the individual carriers to make their contributions to the so-called national freight-car pool."

Touche Ross & Co., Final Report to the Federal Communications Commission on the Comprehensive Review of the Western Electric Company (January 31, 1974) (ALJ Ex. 1)

"Western Electric, overall, is an efficient organization and makes good use of manpower, systems, equipment and corporate relationships in terms of producing goods and providing services according to specification, in sufficient quantity, at the time required, at minimum cost, given that the goods and services ordered by the operating companies were, in fact, required.

Western Electric's efficient performance

has resulted in lower costs than otherwise would have been incurred. Because of Western's pricing policies and practices, these lower costs have not increased profits, but have been passed on to operating companies in the form of lower prices." (p. 3)

"The effect of the interrelationship between Bell and Western Electric is to operate Western, not as a manufacturing concern, but as an integral part of a vertically integrated communications firm. These interrelationships result in a favorable impact upon Western's costs, prices, and service to operating companies." (p. 5)

"The interrelationships between Bell, Western and Bell Laboratories have generally reduced costs and investment." (p. 6)

"There is no evidence that the interrelationships were used, or that the decision-making process was manipulated either to retard successful commercial introduction or to prematurely accelerate commercial application." (p. 7)

"Western Electric employs a full absorption cost accounting system. Its cost accounting practices are reasonable and consistently applied. Generally, the system provides the information required by management to control operations and to apply their pricing policies." (p. 9)

". . . Analysis of this market structure indicates that Western Electric cannot be separated in any meaningful sense from the rest of the Bell System. It is unique as a manufacturer because of its ties to the Bell System and, in an economic sense, it functions as just another part of an enterprise devoted to the production of communications services." (p. 9)

National Export Expansion Council, Report of the Industry Advisory Committee on Telecommunications (1973)

"In the United States, the telephone and telegraph and long-haul communications industries have essentially originated from one source—the Bell System (including Western Electric, Teletype Corp. and the Bell Telephone Laboratories). The growth has been characterized by good systems design, excellent products, and innovative thinking directed toward continually improving the quality-availability to cost ratio in services rendered." (p. 39)

Domestically, the communications industries have grown essentially through the Bell System, including Western Electric, Bell Telephone and Bell Labs. The product lines evolved out of this base have been highly reliable, very advanced, and extremely low cost in terms of services rendered and product line support." (p. 95)

British Select Parliamentary Committee on Natonalised Industries, "The Post Office" Vol. I, Report and Proceedings of the Committee, Discussing the British Telephone System (1967) (p. 168)

". . . regard should be paid to the benefits to be derived from a substantial manufacturing unit under the Post Office's control giving a quick, direct and full feedback to the Post Office's research and development organization of relevant information regarding technical difficulties encountered in the course of manufacture. Such feedback might be expected to be more effective than that which can be obtained, under present arrangements from the private manufacturer. Similar benefits might be gained by closer association of manufacturing and operating responsibilities, both from interchange of technical experience and from being able to relate, as closely as possible, supply to fluctuations in demand. In these ways the Post Office could derive similar advantages to those derived by the Bell System from having research, manufacture and operations under a single control."

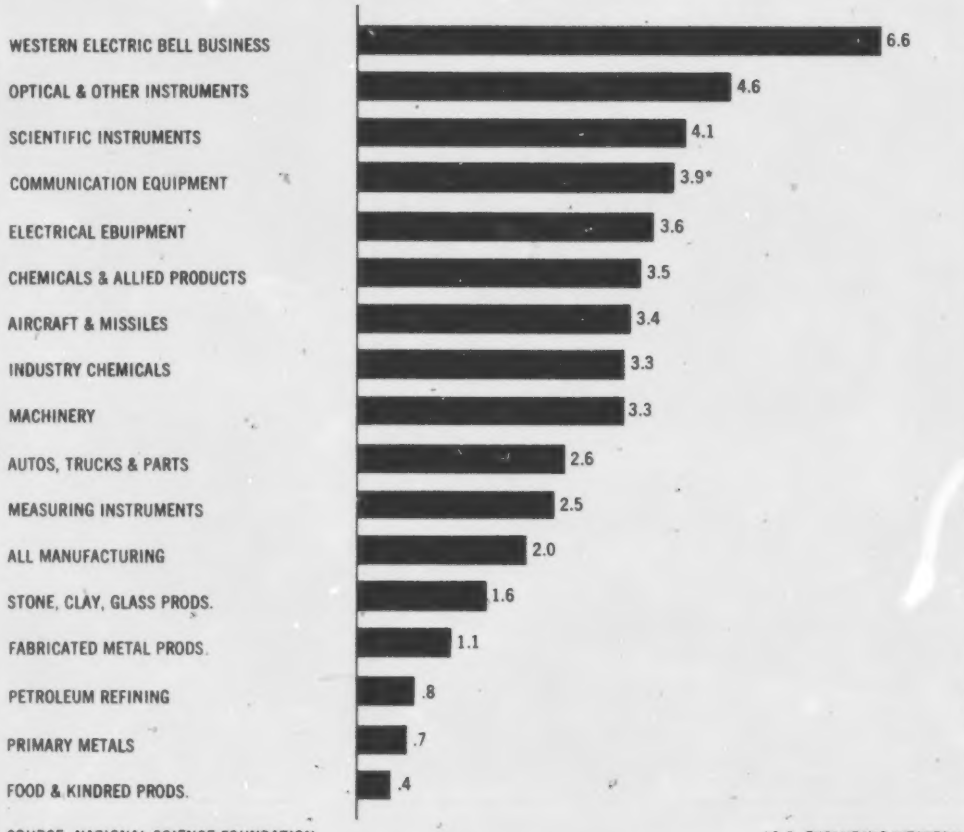
President's Task Force on Communications Policy, Staff Paper 5 (1969) (p. 193)

"The costs and benefits of vertical integration in telecommunications are not easily quantified. On the side of dissolution is our interest in enlisting the resources of the aerospace, computer, and electronics manufacturers alongside Bell Laboratories, so as to increase diversity of approach in communications research and development. On the other side are the delays and cost-control problems associated with contractural procurement. These costs increase as the system being developed grows larger, more complex, and more highly interactive. Therefore, the case for a carrier-manufacturer tie is at its strongest in telecommunications." □

ATTACHMENT K--Bell System Responsiveness to Emergency; The filed statement included a copy of the booklet entitled "Miracle on Second Avenue: The Bell System's Response to a Major Service Disaster and She Restores Service--NOW and Matewan Flood Recovery, from Telephony Magazine, May 2, 1977. Telco Supplies Vital Link to Flooded Colorado Area, Helen Hardin, Contributing Editor, from Telephony Magazine, August 30, 1976, were removed due to poor reproducibility .

ATTACHMENT L

COMPANY FINANCED R & D EXPENDITURES AS A PERCENT OF NET SALES
Average 1966-1975

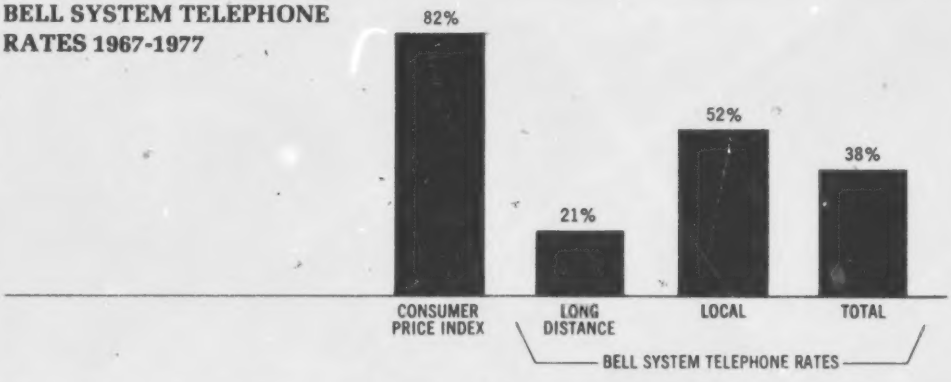


SOURCE: NATIONAL SCIENCE FOUNDATION

*3.5, EXCLUDING WESTERN

ATTACHMENT M

BELL SYSTEM TELEPHONE RATES 1967-1977



UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications

Statement of
Ian M. Ross
on behalf of
American Telephone and Telegraph Company

August 7, 1978

It may strike some as surprising that a representative of Bell Laboratories is testifying with respect to Section 333 of the Communications Act of 1978 which, if we read it correctly, could require the Bell System to divest itself of Western Electric.

I hope that at the conclusion of my testimony my reason for being here will be clear. The purpose of my appearance is to illuminate the nature and value of vertical integration from the viewpoint of Bell Laboratories—something that I believe is not always clearly understood nor immediately apparent to those outside the telecommunications industry.

The purpose of my testimony is really threefold:

One, to put in perspective the role that Bell Laboratories plays in the continuum that is involved in the development and delivery of high quality, reliable, innovative and reasonable priced telecommunications service.

Two, to discuss the critical nature of the close relationship of Bell Laboratories with Western Electric and other members of the Bell System's integrated structure.

Three, to point out the severe blow divestiture of Western Electric would represent to the work of Bell Laboratories and ultimately to the quality and price of service and the pace of innovation.

Before I do that, however, I would like to make some preliminary observations.

I am sure that you need no reminding of Bell Laboratories achievements such as the invention of the transistor, the development of information theory, the exploration of the wave nature of matter, the discovery of the negative feedback principle, and, most recently, the work in magnetism and electron behavior in noncrystalline material for which Dr. Philip Anderson shared the 1977 Nobel Prize in Physics—the fifth Nobel Prize awarded Bell Laboratories scientists.

As illustrious as are these and other achievements that have earned the Bell Laboratories national and international recognition, they may engendre a mis-

perception of what Bell Laboratories is—and where its main efforts are directed.

Some people have the impression that Bell Laboratories is engaged primarily in abstract research. Nothing could be further from the truth.

It is true that basic research is critical in extending the boundaries of knowledge and deepening the reservoir of scientific understanding. This effort is, however, keyed to the long-term needs of the telecommunications industry.

The major portion of our work is on network and systems engineering, development of communications systems and development and design of particular products.

Thus the overall effort of Bell Laboratories is tuned to meeting the long- and short-term needs of the telecommunications system that serves the nation.

Having made those observations up front, let me proceed to position Bell Laboratories in the continuum that is involved in the provision of high-quality, reasonably priced service.

Bell Laboratories is, of course, the research and development arm of the Bell System, owned jointly by AT&T and Western Electric.

Almost half of Bell Laboratories work is spent in specific development of telecommunications products funded by Western Electric. The major portion of the balance of our work is research and systems engineering paid for by AT&T.

In addition, we undertake programs on behalf of Western Electric in various military and government programs. In the mid-1960's about one-third of Bell Laboratories people were engaged in such activities; now, our level of effort in government work is about three percent. We, of course, stand ready to contribute to national defense efforts wherever our particular talents are needed.

Bell Laboratories employs over 17,000 people, two-thirds of them technical. Most of our Members of Technical Staff have advanced degrees, with over 2,000 at the Ph.D. level.

Our headquarters and largest laboratories are in New Jersey for ease of interaction with AT&T General Departments. Most of the research and engineering and some of the development work is conducted at these locations. We also have eight other major laboratories, seven of which are at Western Electric plants, where Bell Laboratories product designers interact closely with Western Electric manufacturing engineers to speed the processes of translating design concepts into finished products.

When describing the overall Bell System organization and where Bell Laboratories fits in, it is tempting to display an organization chart that neatly boxes off Bell Laboratories, Western Electric, the Operating Telephone Companies, etc.

While that might serve as a handy program for the identification of the players, it fails to convey a central attribute of the Bell System, that is, the constant circulation among all the units of knowledge and information, and the critical linkages that occur in the development and delivery of service. Each unit has its distinct responsibilities and functions but no one of them can carry them out without regard for the impact upon the others.

The conversion of scientific knowledge into useful technology that optimizes the performance and cost of the Nation's telecommunications system is a dynamic, collaborative process. It involves AT&T, AT&T's Long Lines Department, the Operating Telephone Companies, Western Electric and Bell Laboratories.

At Bell Laboratories we must understand the needs of the Operating Telephone Companies. We must understand the needs of AT&T Long Lines which manages the long distance network. We must understand the needs and desires of the public that these "delivery" units serve. We must design and develop products and systems that are compatible with existing and contemplated technology. We must understand and take into account the costs of installation, operation, maintenance, and repair. We must understand the technical and physical environment in which our designs will operate.

We must understand the costs, limits and potential of the manufacturing process. And, of course, we must have ready access to and develop a continuously expanding reservoir of scientific knowledge so that we can mesh the opportunities that technology offers with the needs that have been identified.

Thus, we do not conceive products, systems or devices in a vacuum but in the context and as a result of the constant flow of technical, operational, cost, and market data among the various units of the Bell System—and, I might add, the scientific community within and without Bell Laboratories.

The innovative process, while dynamic, is not without structure. The elements in this structure might be described in terms of the following categories:

- Identification of Needs,
- Research,
- Systems Engineering,
- Product Design,
- Manufacture, and
- Purchase and Installation.

I might just briefly review each of these.

First, **Identification of Needs.** AT&T General Departments have overall responsibility for identifying system needs and the opportunities for fulfilling them. Through constant interaction with the Operating Telephone Companies and their customers, AT&T determines preferences and priorities for services. From Bell Laboratories, AT&T determines technical opportunities and the economic factors involved in meeting those needs. In concert, and under AT&T guidance, the various elements provide ingredients for comprehensive plans for network change and the introduction of new products and services.

Research. The purpose of Bell Laboratories research is to advance the science and technology that underlie telecommunications. It is open-ended work with unscheduled results.

Basic research is directed toward understanding the physics and chemistry of materials, the processes of electronic device operation, the fundamentals of electrical communications, the human need for telecommunications, and associated topics.

Applied research at Bell Laboratories is focused on the utilization of basic knowledge to advance the technology needed by the Bell System. It seeks to reach and find applications for the body of knowledge including that built by basic research.

Systems Engineering. Systems engineering work is directed toward planning network evolution and establishing requirements for new equipment to implement that plan.

Bell Laboratories systems engineers analyze the confluence of network needs and technical opportunities for developing broad plans and requirements. In this activity, they work closely and interact with AT&T to reflect and refine overall system needs.

In establishing requirements for new products, systems engineers reflect network needs for performance, reliability and maintainability. In this activity they also work closely, and interactively, with product designers.

Product Design. Specific product design has as its objective the production of manufacturing information—the designs needed by a maker of equipment. In contrast to research, specific product development is tightly scheduled with the timing of results planned before starting the activity.

Within the Bell System, specific product design is a responsibility of Bell Laboratories. Indeed, Bell Laboratories is assigned design control and responsibility for the quality of all Bell System standard products whether or not they are made by Western Electric. This delegation permits Bell Laboratories to control the performance of equipment in the interests of the Bell System network and its users. Thus, while all manufacturers, including Western Electric, shape their manufac-

turing processes to minimize costs, Bell Laboratories is charged with the responsibility of assuring that efforts to reduce the cost of manufacture do not adversely affect service quality.

Manufacturing. Product manufacturers are responsible for creating the procedures and methods of turning designs—component specifications, electrical and physical characteristics, equipment layouts and the like—into finished products. Within the Bell System, this responsibility rests primarily with Western Electric.

Purchase and Installation. The innovation process is complete only when the new equipment is installed and working. Within the Bell System the selection of equipment is made by AT&T Long Lines and by each of the Operating Telephone Companies which join with the Independent Telephone Companies in the operation of the nationwide network.

This discussion of the innovative process conveys, perhaps, the impression that it has the neatness and inevitability of a scholastic syllogism. It is not quite that tidy a process. In fact, I might take you through the dynamics of developing a system innovation. This would not only give you a better flavor of what is involved, it would also highlight, I believe, the value of the shoulder-to-shoulder and day-to-day participation of the various units of the Bell System.

Let us assume, for the sake of discussion, that the need for a service innovation is being investigated and that an idea for the innovation has been uncovered. At this point, early models are made at Bell Laboratories. The operational characteristics and the economies are broadly defined. We may even conduct field experiments. During this exploratory stage, we may well look to the experience of the Operating Telephone Companies to assure that the service could, in fact, function technically in the field and that it would be economically feasible. At the same time, Bell Laboratories engineers consult with Western Electric engineers to determine a rough range of the costs of manufacture. Bell Laboratories engineers also determine whether the service is, or can readily be made, compatible with existing technology and that coming on line.

The data gleaned through this inquiry may well dictate minor or major modifications—or even scrapping the entire concept.

But let us assume that the exploratory results are positive. In other words, on a rough cut, it looks to us as if the project makes sense from service, cost, and market standpoints. Now we shift gears and begin in-depth examination to assure ourselves that specific development of the service is warranted.

If that decision is made, specific development is begun. At this point tri-company teams—Bell Laboratories, AT&T, and Western Electric experts and sometimes Operating Telephone Company representatives—come into play trying to make sure that service, compatibility and cost objectives are met.

I might add that cost effectiveness is no less stringent a criterion to be met than are performance and reliability. Technology offers a wide range of possibilities but they will not be developed unless they can be realized economically. There are a variety of costs to be taken into account: those of design and manufacture, capital required, installation and maintenance, as well as the cost of the additional network modification that may be imposed by the introduction.

But to go on, it is in the specific development stage that design begins to jell.

Field or market trials are launched, particularly in the case of new, essentially untried technology. These trials usually uncover the need for additional changes. Throughout this process, the systems engineer, the developer, the manufacturer and the potential user work closely together to implement the innovation.

Next, manufacture of the product begins. But, even during the manufacturing stage, innovation continues. It is one thing to have a successful field trial; another to infuse a new system into a delicately balanced network. Unanticipated

problems sometimes arise requiring the coordinated efforts of all units concerned. Changes in designs, the manufacturing process, installation or maintenance procedures may be required. New, higher performance or more cost-effective technologies may have come on line in the meantime—dictating their incorporation during the manufacturing process.

For this sort of integrated, cooperative process to work effectively, each member needs to share an overriding common interest. Each needs to deal openly and fully with the other. No secrets. No proprietary interests. No inflexible adherence to an initial set of specifications or design. We have those qualities in the Bell System today because of the integrated structure—and it is a tremendous plus.

In my mind, and I speak from experience, it is this sense of common objective, this open relationship and free-flow of data, problems, ideas among the partners that has enabled the Bell System to phase into operation large-scale enhancements of the network such as direct distance dialing, Touch-Tone® calling, Electronic Switching Systems (ESS) in the local exchange network and, more recently, larger, more sophisticated ESS offices for long distance toll switching. Advances such as these have an impact upon virtually every major aspect of the existing network. They require cooperation and coordination with the operators of that network—AT&T Long Lines and the Operating Telephone Companies.

If our objective is to optimize the network for the benefit of the public—and this is clearly our charge—then Bell Laboratories designers need the freedom, the flexibility to call for the changes that are necessary to achieve that objective. There is no question, because of the interrelated nature of the network, that the introduction of new technology can require modifications throughout the telecommunications system. That is a fact of life in an integrated technical system.

It is not unlike ecology. When one makes a change the effects ripple throughout the entire system. Changes in the telecommunications network today are accomplished readily because of unified responsibility, unified control, and unified management. This unity is required because change may be disruptive. Change may be inconvenient. Change often drives up short-run costs. But if the change leads to long-run savings or enhancement of service, or both, it can be best accomplished promptly and efficiently with an integrated structure where all units are driven by a common goal. This includes the willingness of a manufacturer such as Western Electric to roll with the punches and to make substantial changes in standard product lines, for instance, that are necessitated by new technology.

What I am saying is that the Bell System, because of its integrated structure, is fortunate in having no artificial, no organizational, and no contractual barriers erected in the path of innovation.

And I might add that oftentimes changes, despite our best efforts, are required late in the game or even after the fact, when we get experience with a new service or system. It is a question of "real world" operation versus theory. For as capable as the theoreticians and designers at Bell Laboratories are, as useful as field trials are, no laboratory or trial can perfectly duplicate the real world. This is especially true with respect to a mechanism as complex, interrelated and extensive as the telecommunications network.

Part of the complexity stems from the fact that in the communications industry we are virtually never talking about single-shot, across-the-board substitutions of new technology. We are, instead, talking about a continuous process where new technology enters the existing network, rises to ascendancy—and as it does—is itself in the process of being transcended by yet another more capable, more efficient technology. This unending process of enhancement has been the story of the nationwide network as it evolved from operator-handled calls, to electromechanical, to electronic switching systems.

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The same is true with respect to transmission capabilities which have advanced from a single pair of wires able to carry but one conversation at a time—with considerable noise and distortion—to today's coaxial cable, microwave and satellite systems and satellites which carry thousands of simultaneous conversations—voice and data—virtually distortion free. And, just as in the case of switching, new technologies offering greater capabilities continue to come on line and are diffused throughout the network.

Implicit in achieving that continuous upgrading of the capability of the telecommunications network is a total team effort, including a committed manufacturer that seeks, like the innovator and the user, the optimization of the entire network rather than the optimization of its own profits or private interests.

There are many cases in point. Take, for example, the development of single-side band radio which enables us, through changes in electronics, to utilize microwave towers and equipment already in place to increase by three times the call-carrying capacity of our existing microwave systems. The advent of single-side band requires the manufacture of some very advanced new components by Western Electric, but, at the same time, it cuts deeply into the expected sales of standard microwave equipment in which Western Electric has invested and which it would expect to produce and sell in the future. Western Electric proceeds without question or dispute for the good of the system as a whole. Changes in the manufacturing process, retooling, switching direction in mid-stream, and even, at times, under the direction of Bell Laboratories, stopping shipment of products that do not measure up to standard—all of this is accomplished, if not with joy, smoothly and without extended debate. The reason is basic: shared mission, stemming from the integrated structure of the Bell System.

Of course one of the values of the close relationship of Bell Laboratories with Western Electric is that the manufacturer is privy early to new developments in the laboratories which may put new requirements upon the manufacturing process.

There is no need—in fact the opposite is true—to keep Western Electric in the dark about emerging technology. And the current flows both ways, for Bell Laboratories also is privy to emerging manufacturing technology developed by Western Electric, which operates its own research center to develop more efficient manufacturing processes. These manufacturing advances become a factor in design and in assessing the opportunities and costs of new technology.

Both the designer and the fabricator benefit from this free and open exchange.

It is worth noting, I believe, that in the communications industry, when we speak of manufacture, we are talking in large measure about something totally different from stamping out automobile fenders and assembling washing machines.

We are speaking of highly sophisticated manufacture, for example, of tiny solid-state devices—such as, custom designed, large-scale integrated circuits—one-tenth the size of a postage stamp—containing the equivalent of 14,000 transistors. While solid-state device manufacture has matured and is being performed exceptionally well by numerous organizations, the early development of the solid-state technology was a major challenge. It required most intimate relationship among those working on the fundamental properties of matter, those searching for techniques to attain the degree of purity required, and those who had to devise methods of low cost, high-quality mass production, as opposed to fabricating one or two models with the high skills available in a laboratory.

This is a good example of the dynamics that exist in a team effort which links research, systems engineering, design and manufacture—where the needs of design and development stimulate the research effort and at the same time stimulate and shape the manufacturing process. This is a critical linkage of knowledge and skill,

theory and practice.

The stimulation of research by the needs of design was amply demonstrated after World War II when Bell Laboratories designers were anxious to exploit the full potential of the then new art of electronics. They were hampered, however, by the limits of the vacuum tube—its high power requirements, its relatively short life, and its size. Posed with this problem, researchers at Bell Laboratories began to search for solutions. Out of this effort was born the transistor. But inventing the transistor was not enough. Subsequent discoveries were essential before solid-state devices could be put to work in the telephone industry. I am talking about such important discoveries as zone refining to purify materials, oxide masking, epitaxial deposition, and photolithography. Incidentally, I was there and participated in part of that follow-up work as a member and later Director of the Semiconductor Laboratory at Murray Hill, New Jersey. These advances have enabled Bell Laboratories and the semiconductor industry spawned by this work to progress to the point we have reached today, where low-cost, reliable, large-scale integrated circuits and microprocessing chips are revolutionizing telecommunications and other industries.

Later, as Director of the Semiconductor Branch Laboratory at the Western Electric Allentown Works, where these devices are manufactured, I saw the other half of the equation—the synergy involved in the convergence of design and manufacturing skills. I saw the benefit of Bell Laboratories engineers working side-by-side with Western Electric engineers in the final stages of development and the early stages of production—a particularly critical junction because of the "process" nature of semiconductor manufacture and the highly stringent criteria that must be met in every step of production. Because of this close association of Bell Laboratories and Western Electric experts, problems are averted. When they do occur, they can be addressed by experts on the scene who, if need be, can reach back and draw upon the full technical resources of Bell Laboratories. As a result, technology is brought on line faster and more efficiently.

Branch laboratories, on site at Western Electric manufacturing locations such as Allentown, Pennsylvania, are symbolic of the continuing and productive relationship of Bell Laboratories and Western Electric from which the public has reaped real benefit in terms of quality, reliability, and cost of service.

Two other examples, I believe, underscore the value of the integrated structure.

The first is the development of the high capacity Number 4 Electronic Switching System. The implications that flow from this technology as it is progressively phased into the network are tremendous in terms of cost benefits, speed of service and a variety of services tailored to individual needs. But my focus, at the moment, is not on future benefits as much as on "how it came to be."

As long distance volumes were rising sharply year after year and our forecasters saw the trend continuing to the point of handling some 70 billion messages annually by the year 2000, it became clear that in the future we should no longer rely solely upon electromechanical equipment for switching long distance calls. We needed high-speed, high-capacity machines to do the switching more economically.

Bell Laboratories set to work, drawing on our prior innovations, and designed a totally solid-state, digital long distance switching system, even more advanced than the local electronic switching offices we developed in the early sixties. Capable of handling some half a million calls an hour, about four times as many as the system it replaces, while using far less space and energy, the Number 4 ESS demonstrates how an integrated organization can marshal and plan resources to bring high technology solutions to improve service and lower costs.

The development of Number 4 ESS represented one of the largest investments in capital and engineering man-

hours ever made by a private enterprise. Western Electric made its first expenditure for this project in 1971. Some five years and $400 million later, the first unit came on line in Chicago. A large up-front expenditure—one that I believe few, if any, unaffiliated manufacturers would dare to risk—but an expenditure that is yielding substantial savings in capital and lower operating expenses and will continue to do so over the long run. This was a mammoth effort in which the close collaboration I have been speaking about today was critical throughout the entire process, from design to manufacture to installation.

The second example, at the time, was hailed widely in the media throughout the country: the Bell System's swift response to restoring a New York Telephone switching center on Second Avenue in New York City that was devastated by fire in February of 1975.

All units of the Bell System were involved: network, transmission and switching specialists from Bell Laboratories; experienced installation crews from Western Electric; engineers, managers, cable splicers—all kinds of craftspersons and skilled technicians—from New York Telephone and other Operating Telephone Companies from around the country.

Central office equipment, cable and other material—much of it slated originally for other destinations—were airlifted and trucked to New York. The work proceeded around the clock and in 23 days service was restored—a job that under normal circumstances would have taken some 18 months.

Some called it "the Miracle of Second Avenue." I would disagree. It would have been a miracle had it been achieved without the integration of the Bell System.

The benefits of a unified system were clear: standard equipment, tools, operating procedures and training. Despite the frantic pace, it was not a tower of Babel—everyone spoke the same language. Western had immediate access to blueprints of the Second Avenue central office. That meant no time was lost in selecting the exact kinds of switching equipment to be shipped or deciding how it should be wired upon arrival.

Bell Laboratories specialists were on the scene analyzing the damage, devising equipment restoration techniques, including developing cleaning solvents to remove fire-hardened soot from thousands of switching contacts. Other Bell Laboratories experts assisted New York Telephone Company and AT&T Long Lines in reconfiguring the network to maintain service for other parts of the city.

The New York fire epitomized what we mean by the value of vertical integration. This kind of response—where all units "turn-to" without question, without dispute, for the overall good—takes place time and again in hurricanes, blizzards and floods.

Thus far in my testimony, I have tried to explain the role of Bell Laboratories in the development and delivery of telecommunications.

And, in particular, I have focused upon the close relationship among Bell Laboratories, Western Electric and the other members of the Bell System.

I would like, at this juncture, to shift to the third purpose of my testimony and explore the impact of spinning off Western Electric upon the work of Bell Laboratories and the quality and cost of service.

In one sense, the impact of divestiture is the reverse side of the coin—the negative image, if you will—of the benefits of the close relationship that I have been describing.

Those benefits will largely be lost.

Instead of the close interactive relationships with our manufacturer, we will need to substitute a relationship where the needs of the System and the mission of service will be replaced by the contract and proprietary interests.

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There is simply no way that Bell Laboratories could, for example, count upon independent manufacturers—understandably pursuing only their own interests—to demonstrate the kind of flexibility and cooperation that Western Electric consistently displays in accommodating shifts in design, even abandoning lines of technology, and adapting the manufacturing process.

Nor could Bell Laboratories or the Bell System look to a "divested" Western Electric to somehow continue its old ways under changed conditions. For profit maximization would be the driving force, not network optimization—no matter how high Western Electric's standards might continue to be.

I described earlier the massive effort—the huge advance investment in capital and manpower—required by the introduction of Number 4 ESS. I have asked myself whether, without Western Electric, we could bring about such an innovation, bring it on line in a timely fashion, coordinate it with all other units of the Bell System, and assure that performance, reliability and cost objectives were met.

I am not naive enough to say it could not—or would not—be introduced. However, I have no doubt that, if it were, it would be at a far greater price and in a much longer interval without the dedicated effort of a partner as distinct from a supplier.

As I tried to emphasize earlier, the free flow of information among the designer, the manufacturer and the user of telecommunications innovations has been an essential ingredient in the development and introduction of new technology. And this is equally important for the future, with the wide range of new technology that is coming on line or waiting in the wings – advances such as the Stored Program Control network, the Advanced Communications System, Advanced Mobile Phone Service and fiber optics, to name just a few.

The stimulation from the free exchange of ideas, information and problems may be the most intangible but most valuable benefit that would be lost.

The loss would stem from a variety of causes.

I believe there is no question that nonaffiliated manufacturers would be loath to explore openly and frankly new manufacturing processes with a laboratory—for fear that information would leak to the competition and they would lose an edge.

Lack of this knowledge—knowledge we have ready access to now—creates barriers to the most effective and fruitful thinking in Bell Laboratories. Knowledge of the capability of the manufacturing process is a key consideration in evaluating the usefulness of new technology. In addition, when Western Electric is in the early stages of perfecting improved or new techniques it can look to us for evaluation and technical assistance. This interchange would not exist – certainly not to the degree it does today—in the more guarded environment that divestiture would create.

I also do not believe that we in Bell Laboratories—particularly in the increasingly competitive environment in which the Bell System operates—would be free to discuss promising technology and new ideas for competitive services as we do now with Western Electric to enable them to assess manufacturing requirements.

We, too, would have concerns over the security of information.

The steady decline in the critical interfaces and the free flow of information would, I believe, over time, sap the vitality from Bell Laboratories.

But, what I have been saying thus far in terms of adverse effects presumes, somehow, that Bell Laboratories would remain essentially intact—but be less effective in carrying out its mission. That would be, to my mind, loss enough, for it would ultimately be translated into higher cost, less innovative, less reliable telecommunications service, when it is clear that the times require just the reverse.

But, I have grave reservations about whether or not that presumption is valid. For I believe a more likely scenario is that the ripping out of Western Electric from the fabric of the Bell System would carry with it essential pieces of Bell Laboratories. I am thinking, in particular of the design function. In our case, as opposed to most business, the design function resides in our laboratories rather than in our manufacturing entity. This has made good sense. It has assured that design is not subservient to the manufacturer — that Bell Laboratories design is aimed at optimizing network performance not manufacturing profits.

Removing the design function from Bell Laboratories would be a devastating blow. Three very fundamental things would be lost.

One, we would lose the objective control by Bell Laboratories of design, as I just suggested.

Two, we would lose the close interaction between the designer and those who maintain an overall view of the total needs of the system.

Three, and a very important point, we would lose the benefit of the information, data, and expression of problems that currently flow from design engineers back to our research people, a process I mentioned earlier in connection with the invention of the transistor and the advances in solid-state technology.

This is a critical process. It helps assure the relevance of research effort and it assures that technical problems and innovative opportunities identified at the design level receive the benefit of the deepest and widest range of scientific assessment.

Without that, we at Bell Labs would be severely crippled in our ability to link effectively advances in science and technology with the delivery system.

There is no question in my mind—and I believe that few in the scientific community would disagree—that severing the relationship of Bell Laboratories with the Western Electric would send shock waves through Bell Laboratories and leave it enervated, far less able to do the job it has done well in the past.

The telecommunications system of the country would suffer. The nation would suffer, at a time when the need is to spur, not curb, technological progress.

Frankly, I believe it would be a disastrous mistake. □

UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications

Statement of
Robert E. Sageman
on behalf of the Long Lines Department of American Telephone and Telegraph Company

August 7, 1978

As others have described to you earlier, the public switched network is a highly complex, interactive mechanism consisting of billions of components. The network is constantly growing—and changing. New technology—both hardware and software—is being introduced at a pace unparalleled in our 102-year history as an industry. But the telephone network is unlike other nationwide enterprises in that each of its components—from 1950-vintage switching equipment to the latest microprocessors—is electronically interconnected and, therefore, interdependent.

The unique nature of this network is the underlying reason for the unified, "systems" approach that characterizes the current Bell System organization which integrates research and development, manufacturing and operations.

Today, I'd like to discuss some of the advantages this integrated structure offers to users of the public switched network, based on my experience in Long Lines operations.

First of all, coordination and collaboration between Bell Laboratories, Western Electric and the operating units enable us to meet the changing and growing demands of the network in the most timely, efficient and cost-effective manner. Each of the partners shares a common objective: to optimize and enhance the usefulness and efficiency for the *total* network, not just the part for which it is responsible; for the benefit of *all* the users, not just particular groups.

We also believe that this common objective coupled with a unified organizational structure encourages—and in fact, makes possible—the development and rapid implementation of large-scale technological innovations . . . innovations that have made it almost as easy to place a call coast-to-coast or across the ocean as across the street . . . innovations that have kept long distance rates stable for decades, despite soaring inflation. Today, for example, in the lowest rate period, it is possible to call coast-to-coast for less than a quarter.

Finally, this integrated structure enables us to plan for the unusual and the unexpected . . . to mobilize and deploy whatever resources are needed in response to extraordinary service demands, such as a nationwide telephone call-in program for the President; disasters such as floods, earthquakes or fires; or major fast-breaking events such as a summit conference in a remote location, or a Congressional hearing.

One of the particular points I want to stress is how users and managers of the network benefit from Long Lines' association with Western Electric—our manufacturing and supply partner. That association offers us the best of all worlds. We in Long Lines capitalize on the things that Western does best, such as the development of high-capacity transmission and sophisticated switching systems, but we are also free to take advantage of the offerings of other suppliers. Western Electric, you see, is our captive supplier, but we're not its captive customer.

The major point I want to make is that the long distance network is dependent on the Bell System's integrated structure, particularly the intimate union of Bell Labs' creativity and Western Electric's capability for producing high-capacity transmission and switching systems.

Now I'd like to point out specific examples I have observed of how the unified Bell System structure benefits users of the public switched network, and then comment on some of the potential consequences of fracturing that structure.

ADVANTAGES OF AN INTEGRATED STRUCTURE TO NETWORK USERS

There are, in my view, four major ways in which the integrated structure of the Bell System is crucial to the public switched network.

Integration of R&D, manufacturing and operations insures that the technological needs of the network are met in a timely, efficient and cost-effective manner.

When I speak of a systems approach, I'm really talking about a closely coupled, interactive *relationship* which provides ongoing, continuous communication and feedback between those of us who manage and operate the network and those who innovate and fabricate the technology needed to meet the requirements of that network.

I'd like to describe how that relationship actually functions on a day-to-day basis—in all parts of the business.

Today, in hundreds of locations throughout the country, Long Lines operations and engineering people are working with Western Electric people (and frequently Bell Labs people as well), installing, rearranging, adding to and otherwise reconfiguring the facilities needed to meet growth and changing patterns in interstate and international calling. They also are improving the effectiveness of existing technology, developing new or improved methods for testing and maintenance, planning for future needs and searching vigorously for new ways to provide service more efficiently and at less cost.

Elsewhere in the organization, Long Lines managers work with their partners at AT&T, Bell Labs and Western Electric through various technology committees that review the state of the art and the overall needs of the network in areas such as switching and transmission. This process enables the partners to evaluate alternative technologies and set priorities for new developments. This helps insure not only the timely introduction of new technology but also the most efficient allocation of resources by the research and manufacturing units.

Over the years, the network has evolved using a mix of transmission and switching facilities, the only criteria being which technology would best serve the total needs of the network and thus provide the most economical and efficient service to the public. Being both a diverse manufacturer and a working member of a partnership that has a single objective, Western Electric is not wedded to any

particular technology, as are most independent suppliers.

Let's look at an example of how this relationship actually works out in practice. In the 1960's, our long-range network planning showed a growing need for a larger long distance switcher, even though the existing 4A crossbar system was the largest and most sophisticated toll switcher in the world. Long distance volumes were becoming such that we would be — and in many cases already were—needing costly multiple switching installations in most large cities. Forecasts showed we would need more than 800 new switchers by the end of the century, including as many as 20 in cities such as New York and Los Angeles. This proliferation of switchers would significantly reduce the efficiency of the network because of the multiple switching of calls and the thousands of extra circuits needed to interconnect the switchers.

Continuous dialogue between Long Lines engineers, AT&T, Bell Labs and Western Electric resulted in one of the largest and most complex projects ever developed by private enterprise — the 4ESS electronic toll switcher. Today we have about 20 of these in service, with more than 100 planned for operation in the next 10 years. Each 4ESS is capable of handling some 550,000 calls per hour (150 every second), more than four times the call-carrying capacity of its electromechanical predecessor, the 4A. In addition, it requires only a fifth of the space and one-third the maintenance cost of 4A systems with comparable capacity. The 4ESS is also an energy saver, requiring only half the power needed to run 4A systems handling the same number of calls.

But there was much more to the development of the 4ESS than just a single piece of technology. The 4ESS had to be compatible with existing equipment within the network. Here's where the teamwork of our partnership arrangement really paid off. Not only did we develop a switcher that achieved compatibility, but we also were able to fashion it so it could be integrated into various automated testing and maintenance systems we were developing, as well as the data processing and other information systems we use to monitor, plan, forecast, manage and build the network.

For example, we were able to tie the 4ESS into an automated testing system we had developed with Bell Labs and Western Electric. Testing of trunk circuits used to be done manually, one at a time, with a technician at each end. With the new system, large bundles of trunk lines can be tested automatically and simultaneously. We also have been able to incorporate features into the 4ESS which otherwise would have required stand-alone systems, such as a component which eliminates the "echo" effect on calls traveling over longer distances.

As you can see by this example, there is a lot more to the integration of technology than just making the hardware compatible. In today's network, the key to making the various systems interrelate and interact is *software*—the programmed instructions or "intelligence" within each system that directs its operations and functions. More and more, we are moving toward a network whose evolutionary nature is being shaped by changes in software as well as physical components. The network is not just a collection of *machines* plugged into one another. Rather, it is a unified *system*, the result of a careful, continual merger of various systems and subsystems.

I believe our experience with the 4ESS is a convincing example of how organizational integration enhances technological integration, which leads to greater efficiency and substantial cost savings. Only an affiliated supplier, with an up-to-date, working knowledge of all the components of the network, could achieve these kinds of results.

In reality, development of the 4ESS is a continuing process. Collaboration and feedback, which occur on a daily basis between the various partners around the country, are producing a steady stream of refinements, innovations and new fea-

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tures, so much so that 4ESS machines being installed today are substantially different from the ones we put in even a couple of years ago. And, of course, the partners are still finding ways to increase the efficiency of the existing 4A switchers.

This dynamic, evolutionary nature of network technology is one of the main reasons why it makes such good sense, particularly on major components, to integrate the manufacturing of communications equipment with the provision of communications service. Our network—and all its related subsystems—are changing so fast that we often have to begin work on projects without detailed specifications. Without an affiliated supplier, we would either have to delay the development of new projects until we could draw up detailed specifications or be prepared to pay enormous penalties for design or manufacturing changes. With an in-house supplier with whom we share common objectives, we can proceed quickly to develop or refine technologies without the rigidities of detailed bidding procedures or contractual roadblocks.

And, because Western Electric is motivated by network objectives and not just its own profit considerations, we can count on it to provide new or improved products when we need them, even when doing so adversely affects its existing product lines, and to accommodate demands for expedited production or sudden reductions or cancellation of previous orders.

For example, to speed up the processing of calls through the 4A switcher, we asked for and got a new electronic translator system—a device that selects the best route for your call. By increasing the call-handling capacity of the switcher, this innovation resulted in our cancelling plans for ordering 46 additional 4A machines, which cost up to $15 million each. Then, of course, development of the 4ESS just about stopped the 4A line and severely disrupted the operations of Western's Omaha and Columbus plants. Converting from electromechanical to electronic switching, you see, was not like retooling an automobile plant for the next year's models. Since the 4ESS involved a completely different technological concept, it also required a radically different manufacturing facility. Nevertheless, in order to meet this pressing network need, Western did not hesitate to incur all the resulting costs and disruptions to its orderly manufacturing process.

Another advantage of having an affiliated supplier is its ability and willingness to retrofit and upgrade existing communications systems at a reasonable cost. For example, when Western started producing microwave facilities with solid state components, we asked them to develop solid state devices to replace the vacuum tube components in our existing equipment bays, rather than install new bays. An outside supplier, I believe, would have been more enthusiastic about selling us a new system, rather than upgrading an old system. With a captive supplier, we are assured of continuous manufacturing support for any of our systems throughout its life.

With an affiliated supplier who knows the intricacies of our network and with whom we can share information freely, we can play all kinds of speculative, "what if" games, exploring various alternatives for meeting future service demands or developing innovative new services. A good example is the process we use in making long range plans for the network.

That process begins with projections of network growth for up to 13 years, not just aggregate figures but detailed estimates keyed to calling volumes between specific locations. From this, we begin to calculate future plant requirements.

The Labs tell us what new technologies will likely be available and when, and estimate the costs in consulation with Western Electric. Then, working together in an open, cooperative relationship, in which the flow of ideas is unimpeded, we begin to consider various options and tradeoffs, weighing one approach against

another, to determine the technological mix that will most effectively meet the needs of the network. Long Lines then is able to develop specific plans for reconfiguring the network, the Labs to move ahead on needed research and development and Western to reshape its manufacturing capabilities.

We could not do this nearly as effectively, if at all, if we had to deal with a host of competing suppliers, each looking out for the interests of its own particular product line or specialty.

However, as I mentioned earlier, we are not wedded to Western as a supplier. We can and do procure equipment or facilities from other suppliers, as we have, for example, with satellites, test equipment, ocean cable and microwave generators. For example, in 1977 about a fourth of Long Lines' communications equipment needs were met by suppliers other than Western Electric. Of course, Western Electric also looks to other manufacturers for items which can be produced cheaper or better by someone other than Western. The main point I'm trying to make is that our integrated structure gives us all the benefits but none of the burdens of competitive procurement, while retaining the flexibility that only an affiliated supplier can provide in meeting the unique needs of the network.

The integrated structure fosters innovation.

The constant development of new and improved equipment is a cornerstone of the Bell System's ability to perform its service role properly. We can point to numerous specific examples within the interstate network of how this interaction between Long Lines, the Labs and Western has produced dramatic results, both in the innovation of new technologies and in the improvement of existing facilities.

A primary step in innovation, of course, is the funding of research and development that will lead to new or improved technologies and the capital investments needed to manufacture them. As I noted earlier, Western Electric, being committed to the service and efficiency objectives of the operating units, directs its investments toward the optimization of the network rather than optimization of its existing manufacturing facilities or product lines.

For example, Western Electric invested $400 million in the 4ESS, knowing this project would reduce its present and future switching equipment sales by hundreds of millions of dollars, and knowing it would be years before it could fully recover its investment. I believe it's safe to say that no unaffiliated manufacturer would have been willing to invest this much on a project of this magnitude and risk, without a firm order and without the prospect of earning substantially more than Western's modest rate of return.

In addition to insuring funding for this project, the integrated structure also speeded its development. Using common data and jointly used facilities, the Labs and Western worked closely from the earliest stages of development.

This intimate relationship enabled the partners to compress the production schedule by proceeding concurrently with design and manufacturing processes. Components were manufactured in production quantity during the development period. Four laboratory prototype systems were built by Western Electric in developing the design—all of this prior to receiving the first order.

The result of this team effort, we estimate, will save nearly $3 billion in costs by 1985. Equally important, it will enhance our ability to handle enormous growth in telephone calling in an efficient manner as well as provide new and innovative services to meet the changing needs of customers.

The 4ESS is a key link in the evolution toward an all-electronic, stored program controlled network which, as Mr. Tanenbaum indicated, will have flexibilities and capabilities beyond anything we've imagined in the past.

Development of the 4ESS, along with

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modifications we've been able to make in existing switching systems, have also enabled the Bell System to develop a new signalling system for the processing of long distance calls. Called Common Channel Interoffice Signalling (CCIS), this new process will in effect provide the network with a new central nervous system. It literally is going to revolutionize the nationwide network, not only in the way we manage and operate it, but also from the standpoint of the opportunities it will provide for new and innovative customer services, such as the ability to dial credit card and collect calls without any operator assistance.

With this new system, the information required to set up a long distance call will travel over a separate high speed data link rather than the circuit which carries the voice conversation. In addition to reducing the time required to complete a long distance call by five to six times (down to one or two seconds), it will enable us to utilize the network better and thus hold down costs.

But CCIS's greatest capability will be the almost limitless variety of new services it will make possible. Because of its enormous capabilities of transmitting and storing information and instructions related to long distance calls, ultimately, we'll be able to program the network to provide customized services tailored to meet the special needs of users. For example, a nationwide service or sales organization could have a single In-WATS number which would automatically route calls to its office nearest the calling party. Another possibility would be a nationwide 911 emergency number which would automatically route calls to the nearest emergency switchboard.

What's more, this new way of processing long distance calls will reduce the possibility of electronic toll fraud. And it will substantially enhance the privacy of customers' communications, since the information which identifies the calling parties will not be carried on the same path as the actual conversation. This is just one example of the Bell System's long term commitment to protecting the privacy and security of the communications services we provide.

Since it will ultimately involve every switching office in the country, developing and implementing this new signalling system requires intensive coordination within the Bell System. Like the introduction of nationwide direct distance dialing, this conversion could only be accomplished by a closely coordinated, cooperative effort by organizations committed to common objectives.

Other examples of innovation that stem from the integrated structure include the development of new, high-capacity transmission systems and, equally significant, refinements that increase the capacity of existing systems.

Microwave radio transmission is the most dramatic example. The Bell System introduced this technology into the network in the late Forties, a development, incidentally, that made possible network television. Today it is the backbone of the interstate network, providing more than 70 percent of our capacity. Over the years, Western Electric and the Laboratories, working with the interstate partners, have substantially increased the call-carrying capacity of the existing routes through continuous refinements and replacements of electronic components. For example, a TD-2 microwave system, which originally provided about 2400 voice circuits, now can handle 16,500 circuits—a seven-fold increase of its capacity. A new development we're beginning to implement, called single sideband, will triple again the capacity of many of our existing microwave facilities.

Another example of upgrading existing transmission facilities is our experience with coaxial cables. In this case, by developing new associated electronics we've been able to boost the capacity of a single pair of coaxial tubes from 600 to 13,200 voice circuits—an increase of 22 times—using the original buried cable. As a result, our largest coaxial cable can today handle up to 132,000 simultaneous

conversations.

Because of developments such as these, we have not had to construct any major new domestic transmission routes since 1974 and will not need to for several more years, despite steady growth in long distance calling.

The partnership arrangement also fosters the development of innovative new services to meet the specialized needs of particular customers such as the government and large nationwide businesses.

Examples of this are the government's Federal Telecommunications System (FTS) network for civilian agencies, which is larger than the total telephone systems of many nations, and the Defense Department's Automatic Voice Network (Autovon). Together, these networks have as many telecommunications circuits as the entire Long Lines interstate network had 20 years ago. The integrated structure of the Bell System permitted these networks to be conceived, designed, built and installed quickly and efficiently. And these networks are continually being enhanced by application of new and improved technology developed by the creative interaction of Bell Labs, Western Electric and the operating telephone companies.

Because of its unusual communications needs, the federal government is often on the leading edge of telecommunications innovations. For example, it was one of the first major users of electronic switching and data communications. Many of its systems require unique features. The Autovon network, for instance, has extensive automatic rerouting and preemption capabilities to insure the completion of priority calls.

The Bell System's integrated approach in developing, implementing and operating these systems has proved so effective that the government has frequently sought our help to develop similar approaches for the communications systems it operates overseas. For example, during the early stages of the American military buildup in Southeast Asia, the government called on the Bell System to provide a team of Western Electric, Bell Labs and Long Lines managers to direct an integrated approach for the installation and operation of the military's diverse communications systems there.

Another example of how innovations flow from the interaction between Long Lines, Bell Labs and Western Electric is the development of a low-cost digital transmission process. Several years ago, Long Lines and other Bell operating units identified the need for a digital transmission service that would meet the specialized requirements of customers who use data communications to send large amounts of encoded information between different locations.

Building on their experience in developing and refining other transmission systems, Bell Labs developed and Western Electric manufactured a system that would provide digital transmission over our existing microwave facilities by making use of generally unused portions of the frequency spectrum. In this way, we were able to achieve a major innovation without building new microwave routes or displacing existing voice circuits.

Integration provides cost advantages which directly benefit ratepayers.

Let me give you some concrete examples of the cost advantages that stem from innovations the integrated structure helps make possible—advantages which result in direct monetary benefits to the public.

Development of the new and improved high-capacity transmission systems I mentioned earlier have helped cut the Long Lines average plant investment per circuit mile from more than $40 in 1955 to about $22 in 1967 to less than $15 in 1977. The additional cost of a new circuit in the network today is substantially below this.

This, of course, has had a dramatic effect on our interstate construction costs. For example, Long Lines' annual costs for new microwave circuits dropped from $113 million in 1966 to about $23 million last year, even though the demand

for circuits and our use of microwave grew steadily.

As a result of these and other efficiencies that have been achieved by joint efforts of the Bell System partners, total Long Lines construction expenditures last year were 33 percent *less* than our 1966 construction program—or 64 percent less if you adjust the figures to reflect the decreased purchasing power of the dollar due to inflation.

The bottom line payoff for the average telephone user is that we have been able to achieve remarkable results in holding the line on interstate rates. In the period from 1967 to 1977 during which the consumer price index rose more than 80 percent, interstate long distance rates increased only about ten percent, despite the fact that, like everyone else, we have experienced significant inflation in many of our operating costs.

But there's more to the story than just stable long distance rates. As you already know, under the present system, revenues from interstate calls provide a significant support toward the cost of providing local exchange facilities. On the average interstate long distance call, that support amounts to about 65 cents. Overall, about 30 percent of the interstate revenues, some $4.2 billion, goes toward supporting exchange services through a process known as separations.

I realize the separations issue is addressed elsewhere in the current legislation. However, the point I want to make is that regardless of how the separations question is ultimately resolved, one point remains clear—the public has benefited from our record in holding down the costs of interstate long distance service. I submit that one of the indispensable ingredients in our being able to do this in these inflationary times is the integrated structure of our industry.

Another advantage of the integrated structure is our ability to mobilize and deploy needed resources to respond to emergencies or special service needs.

I could cite numerous examples of how the Bell System partners have responded to natural disasters and national emergencies—with results that could only be achieved by the close interaction of research, manufacturing and operations.

Other witnesses have already described how we responded to catastrophes such as hurricanes, floods and the Second Avenue fire in New York City.

But nowhere are the benefits of the Bell System's integrated structure more critical to the public interest than in the need to insure the security, survivability and reliability of nationwide communications during times of national emergency.

For example, when the 1962 Cuban missile crisis brought to a shocked world its first nuclear confrontation, the Bell System was asked by the government to deploy massive communications facilities on an emergency basis to support a military buildup in Florida. Combined and coordinated efforts by Western Electric, Long Lines and the Bell operating companies achieved almost incredible results. Within days, a host of communications, including a thousand new circuits and a complete new microwave radio relay system, had been installed. Though the example is a few years old, the point it illustrates is still relevant today. The resources of that Bell System team are still there and available.

The Bell System has a long and impressive record of building and maintaining sophisticated and secure communications systems for the government's military and civilian establishments, ranging from early warning defense systems, space detection and tracking systems, airborne command posts, and, of course, the massive Autovon and FTS systems I described earlier.

In addition, we have taken steps to insure the survivability of the domestic public switched network in times of national emergency, including the construction of blast resistant underground facilities, communications routes that avoid target areas and other alternate routing and restoration capabilities.

But the ability of the Bell System part-

ners to respond to special needs is not limited to national emergencies. It extends as well to less dramatic but still serious problems such as a switching malfunction or an accidentally damaged cable or microwave tower. When troubles develop that could threaten service to a city or an entire region, Long Lines is able to draw immediately on the immense resources of the other Bell System partners, as well as employ the restoration and rerouting capabilities of its own national Network Operations Center.

In addition, if technicians encounter problems on a 4ESS which they can't handle, help is available within seconds from a national center staffed and operated by Western Electric for users of the 4ESS. Linked to the local office by long distance circuits, these experts can tap into the memory of the ailing 4ESS system, conduct computerized diagnosis and develop solutions, often in a matter of minutes. For more chronic or serious problems, special teams of Long Lines, Western Electric and Bell Labs experts can be deployed quickly.

Whenever and wherever there's a problem in the network, the Bell System partners' first response is always to get the trouble fixed, not try to figure out whose fault it is. In the final analysis, this joint commitment to service is probably the most significant public benefit of the Bell System integrated structure.

DISADVANTAGES OF FRACTURING THE INTEGRATED STRUCTURE

I have outlined what I see as the advantages of the Bell System integrated structure to users of the nationwide public switched network. I would like now to give you my view of what the consequences would be to users of the network if that integrated structure is fractured, particularly if the Bell System were forced to divest itself of its supplier of high-capacity switching and transmission systems.

I realize there are two sides to most arguments. But in this case, I cannot think of a single way in which divestiture of Western Electric would benefit the users or the managers of the public switched network.

The only thing it would do—as far as Long Lines is concerned—is to deprive us, and ultimately the general public, of every one of the advantages I have outlined today.

Divestiture of Western would not just deprive Long Lines of an efficient supplier—whose procurement, quality control and installation functions we would simply have to duplicate internally, at a higher cost. But, as Mr. Tanenbaum and Dr. Ross have pointed out, we would also be left with a severely crippled research and development organization.

But more damaging than either of these negative impacts standing alone would be the uncoupling of the links in the synergistic process that is producing an impressive flow of new technology and creative solutions to the needs of the network and its users.

The most profound impact of divestiture on the network would be in the development of large, complex projects such as high-capacity switching and transmission systems, for which the number of potential customers is very small.

Also, these systems, which require both high technology and high capital investments, sometimes must be produced in limited quantities. What's more, they may be surpassed by newer technologies before the manufacturer recovers its investment. Sometimes, changing needs of the network or different technology may pre-empt a system before it is even produced but for which sizable outlays have already been made for research and development.

I've already described the high-capital, high-risk development of the 4ESS. Carried out under the ideal conditions of the integrated structure which permitted early and close collaboration between the research and manufacturing units, this project still required five years between initial investments and initial shipment.

and even longer for Western to reach the break-even point.

It is difficult to imagine any other company, including any portion of a dismembered Western Electric, putting such a large percentage of its financial resources on the line for one project, in the hope that after five years of development, the customer will still be interested, that no other technology or product will have come along and that sales will continue until the firm makes a reasonable return on its investment in the project.

This is not to suggest that systems of this magnitude could not be developed outside an integrated structure. But I cannot think of an alternative process that could provide comparable results, not only with respect to funding capability but also in the speed, quality and cost efficiency of the innovation itself.

In order for such systems to be developed, Long Lines, as the managing partner of the nationwide network, would have to fund the development by a manufacturer, who would then be assured of obtaining the production contract for such systems. Thus locked into a single supplier, Long Lines would have no assurance—as it does with Western—that such an unaffiliated contractor would develop the least-cost system from the technological alternatives available, rather than the one that would provide *him* with the most profit. Further, as I pointed out earlier, the dynamic nature of the network's technological needs could provide the contractor lucrative opportunities for additional profits because of change orders.

Long Lines would face similar uncertainties with respect to procuring research and development of new systems. It is clear to me that fragmenting the present integrated structure would precipitate major changes in the organization, focus and, ultimately, the capabilities of Bell Labs.

If that restructuring resulted in our also having to deal with unaffiliated research and development firms on major projects, we would face problems similar to those we would encounter dealing with unaffiliated manufacturers.

Uncoupling the bonds between the Bell System's R&D, manufacturing and operating units would, in addition, deprive the network—and ultimately the users of the network—of other benefits of Western Electric, including its impressive record in reducing the costs of the products it produces and procures for the interstate network. Granted, an independent Western Electric could continue to meet many of the network's needs, but its primary purpose would no longer be the continued enhancement of the network—for the benefit of the average telephone user. Rather, its major motivation could only be the pursuit of its own profitability.

Obviously, fracturing the Bell System integrated structure would not destroy the public switched network. It would continue to exist and function. But there is no way, in my view, that such a move could produce anything but a slowdown in the development and an increase in the costs of the public switched network. If this happens, the ultimate losers will be the *users* of the network.

CONCLUSION

I believe this and other testimony presented to this subcommittee will demonstrate that the integrated organizational structure of the Bell System is essential to the preservation and enhancement of the nationwide public switched network —a vital national asset.

As I have outlined, it is that structure which enables Long Lines and the other interstate partners to meet the technological and service needs of the network and its users in a timely, efficient and cost effective manner. The close union between research and development, manufacturing and operations also spurs innovations which provide direct, measurable benefits to the public in terms of low cost, high quality interstate services. And it enables the Bell System to respond quickly and effectively to national emer-

gencies or special service needs.

Any fracturing of that structure would of necessity destroy the very process which has helped Long Lines and the other partners to provide these benefits to the public.

The record we have achieved, in the quality of the service we provide and in our successful efforts in holding down the costs of that service, speaks for itself. I believe that a close and complete examination of this record will show that a critical factor in achieving this success has been an integrated partnership in which those who design, manufacture and operate the network work together toward a common goal: providing the best possible local and long distance telecommunications service at the lowest possible cost to all users. □

UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications

Statement of
Charles Marshall
on behalf of
American Telephone and Telegraph Company

August 8, 1978

I feel I can speak with confidence about what our customers want, about what they need, about what promotes their best interests and what does not. I understand their expectations about having good, reasonably priced communications services and I understand their frustration and discomfort when things go wrong—when service is delayed or when something doesn't work right. I know what it takes to make good service happen and I know what causes problems.

As president of an Operating Telephone Company, my primary responsibility is to assure that customers—more than three million of them in Illinois—receive the kinds of reliable, high quality, reasonably priced telephone services they need and want.

That's not an easy job. And it is not a job that can be carried out solely by the men and women of Illinois Bell—no matter how competent and how dedicated they may be, and they are both.

Just as critical to Illinois Bell's performance are the talents and skills of the diverse members of the team of Bell System communications organizations who work together day and night—serving Bell System customers in cities, towns and farms throughout Illinois and elsewhere—individuals who conceive, design, develop, build, install, operate and repair the equipment that carries the messages.

One of those organizations is the Western Electric Company, and I would like to discuss with you the crucial role of that company in helping me meet my service responsibilities, the importance of that company to the Bell System as a whole, and the adverse effects of adopting Section 333 of the proposed Communications Act of 1978, which—as I read it—would remove Western Electric from Bell's vertically integrated structure.

To me, the words "vertical integration" stand for a purposeful organization with a great many people working together to provide — through modern technology — high quality, reasonably priced communications services for everybody who needs and wants them. I rely on those people—

indeed it is second nature for me to do so—to help me meet my responsibilities. I am confident of their ability and confident of their dedication.

In short, what I'm saying is this: If I do my job well—as I hope I do—it is largely because of the outstanding support I receive every day from individuals who work throughout the Bell System. Not just from the men and women of Illinois Bell, but from those at the Bell Laboratories; from those in the Long Lines Department of AT&T; and from those in a parent company to whom every member of this team can—and does—turn for advice and assistance. And standing on an equal footing is the Western Electric Company—an outstanding manufacturing company—which meets our needs quickly, efficiently and economically. The help we receive from the people at Western Electric is as vital to the success of Illinois Bell as the work of our own employees.

My convictions about the provisions of Section 333 are strongly held, largely personal, and based mostly on my experiences in Illinois and Texas. I am certain, however, that they reflect the views of my counterparts in every Bell System Operating Company in the country—and the customers they serve as well.

Let me say first that, theoretically, I know there are other ways to optimize a structure such as the Bell System. But I know of no other structure which could benefit the American public more than the present organization which:

- provides customers the benefits of a total systems approach to their communications needs.
- ensures that technical innovations will keep pace with customer needs for tomorrow.
- makes possible services to customers when they want them—whether in a crowded urban center, in a new suburban housing development, in college towns or in rural areas.
- equips Operating Telephone Companies to deal with disasters and to restore disrupted service quickly.
- provides services that are reliable at prices most people can afford.

In short, I doubt that there is any basic structural change—and certainly not one involving the divestiture of the Western Electric Company—which could improve the degree to which customers enjoy the benefits of the present Bell System structure.

Although Western Electric is the manufacturing and supply arm of the Bell System, and although they do indeed make equipment for us, deliver it, install it, and repair it, they are not our sole source of supply. In the purchase of supplies and equipment, I have a choice. I can buy from Western Electric or I can buy elsewhere. If I can do better elsewhere, I buy elsewhere.

In recent years Illinois Bell has bought from a variety of suppliers such equipment as portable central offices, switchboards, converters that bring Touch-Tone® service to customers in smaller communities, cable connectors, and many types of products for use in our business. I should point out, too, that Western Electric—in its role as our principal supplier—itself buys hundreds of millions of dollars in equipment from other suppliers on behalf of the Operating Telephone Companies. Last year in Illinois alone Western Electric purchased $313 million worth of equipment from 4,993 suppliers in 263 communities.

How do we decide which supplier to use? By regularly studying and comparing product quality and price. We look at available products, their cost and quality, and make our decisions based, in the end, on what best serves our customers' needs. It is true that more often than not it makes sense—both technologically and economically—to buy from Western Electric.

As part of the Bell System, Western Electric is managed in the interests of the Bell Operating Telephone Companies and their customers. Western Electric is obligated by the Standard Supply Contract—

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a concept incidentally which originated in Illinois in 1904 with what was then known as the Chicago Telephone Company—to care for the needs of the Operating Telephone Companies. But nothing in this unique contract obligates the companies to buy from Western Electric if they prefer to buy elsewhere.

Caring for the needs of the Operating Telephone Companies means that Western Electric is managed in the interests of companies and their customers, and not for the narrower interests of the manufacturer itself.

This is a great advantage to us. For one thing, it means that Western Electric is motivated to be ready to fill our orders even before we send them. As a result, its delivery intervals are shorter than those of other manufacturers. We can use shorter-term—and thus more accurate—forecasts and so avoid unnecessary capital investment in excess capacity and inventory.

Western Electric's service operation, organized by regions, can serve telephone companies throughout the country. It maintains a mobile force specially trained to install complex equipment. And this means that the time interval from the moment Western Electric receives an order to the time the equipment is installed is much shorter than that which other manufacturers can offer us.

Western Electric custom tailors central office and other major equipment to fit each installation. Since no two central offices are exactly alike, Western Electric keeps updated engineering drawings on the equipment at every company location. Hence, without the need to undertake extensive study of existing installations, Western Electric can quickly tailor any new order to fit with our equipment already in place. As a result, Western Electric generally charges substantially less than other suppliers charge for similar work.

Quality is another important factor. I want what Illinois Bell customers want—the best possible service. That calls for equipment that will last a long time and will be as free of trouble as possible. Western Electric's standards are set by Bell Laboratories in the interests of the Operating Telephone Companies. And Bell Laboratories inspect Western Electric's operations and check its products.

Their design and manufacturing engineers work together and the manufacturer carries out the purpose of the design in ways that could never be expressed in specifications alone.

This arrangement is a great help to our planning process. A telephone company like Illinois Bell can look ahead, anticipate customer needs and demands, and know that what we need will be on hand when we need it, where we need it.

Moreover, we can be sure that it has been properly inspected and has passed the test of Western Electric's rigorous quality control; that it will be delivered and installed on time; that it can be made available in whatever quantity we want; and that if we find we do not need it, we can send it back to Western Electric for credit.

This is important to us—and important to our customers. The telephone business is capital intensive. In 1977, Illinois Bell alone spent nearly half a billion dollars on new construction, increasing our plant investment to nearly $5 billion. Not surprisingly, we have to make sure we get every dollar's worth out of our purchases. We have to make sure we don't have to pay premium prices to make new telephone equipment work with the kind we already have. We have to make sure that what we have can be modified and updated when new technology comes along.

Western Electric has some 40 service centers located strategically around the country—warehousing thousands of items to fill telephone company needs. Usually we can get such items anywhere in Illinois within 24 hours after placing the order.

If a customer in Decatur, Illinois, needs a green six-button telephone set tomorrow and we don't have one in stock there, we contact the Western Electric distributing center. When the regular supply

truck arrives at the crack of dawn in Decatur it will have on it that green telephone, and our installer will have it on his truck when he leaves the garage at 8 o'clock.

Illinois Bell is, therefore, spared the expense and the inefficiency of keeping every style and every color telephone on our shelves in every community we serve. And the cost to us is the same for one set as it would be for a hundred. That's because Western Electric gives us its lowest price regardless of the quantity, so that each Operating Telephone Company can enjoy the benefits of Western Electric's low cost resulting from its high volume of production for the entire Bell System.

Western Electric, by being integrated in the Bell System, does a great deal more for us, however, than simply responding to orders for a single phone.

In Texas, we experienced an unusual surge in growth in the Houston area, causing unanticipated increases in demand for telephone services. When we determined that our planned equipment additions would be less than needed to serve fully the area's soaring population, we turned to Western Electric for a solution. They immediately analyzed their entire production schedule to determine whether other Operating Telephone Companies could absorb brief delays in some of their equipment orders without degrading service elsewhere. Western Electric found, in fact, that several companies around the System were experiencing less growth than they had anticipated. As a result, Western Electric was able to negotiate delays in those orders and divert to Houston the equipment needed.

An unanticipated surge of growth is one thing, but a natural disaster is another.

Bell System witnesses spoke yesterday about the 1975 fire which destroyed one of the largest switching offices in lower Manhattan, silencing more than 170,000 telephones. It was New York City's disaster, but I assure you it was the whole Bell System's concern. At once, Western Electric marshaled equipment from all over the country. They sent technicians and installers. Bell Laboratories, Long Lines and many Operating Telephone Companies sent specialists to the scene. It was a massive problem, but it got massive assistance from every unit of the Bell System. I can tell you that every Operating Telephone Company volunteered help. Nearby New Jersey Bell and New England Telephone sent people and material to the scene at once. For our part, central office equipment being readied for shipment to Illinois Bell by Western Electric was diverted to New York. So too were many Western Electric technicians, who were at work on Illinois Bell installation jobs. We also offered, and almost sent, a new electronic switching system then being installed in a Chicago suburb, but a similar office was available nearer the disaster site.

Illinois customers have experienced their share of natural disasters, too . . . and have seen the benefit of the Bell System's response.

In 1972, a flood disabled telephone service in suburban DuPage County. Again, Western Electric came to the rescue. They rerouted and air freighted a complete Centrex system from Denver and installed it overnight.

When a tornado smashed through Canton, Illinois in 1975, and knocked out phone service for more than half the community, Western Electric had cables and supplies on the way within hours. Service was completely restored to hundreds of customers within a week.

Quite apart from disasters, Western Electric's value to us at Illinois Bell is realized in other, but no less appreciated ways. Take, for example, the work they do to assure equipment compatibility. This is extremely important to us at all times, but particularly when introducing the new technology that is coming so fast in our business.

Most suppliers, I suspect, would be less interested in giving us the hardware that makes possible the bridging of the old with the new, in favor of selling us entirely new systems. Since we can't afford to

throw out perfectly fine equipment, Western Electric helps us find ways to bridge the equipment generation gap, allowing us to realize the full potential service life of the original equipment. This results in enormous cost savings to us and our customers.

Another way Western Electric serves us is by assuring the availability of spare parts at reasonable prices, maintaining usable equipment in the field and thereby preventing costly premature obsolescence of our facilities, and by making possible reuse of displaced equipment.

Suppose—for good and sufficient reasons—we want to install a new electronic central office for our customers in Rockford. After Western Electric replaces the older electro-mechanical office, they ship it to a nearby repair facility for complete reconditioning.

Illinois Bell still owns those frames—maybe 100 of them—and we'll reuse them when we need them for growth in another Illinois community or, if they are needed elsewhere in the Bell System, we may sell them to another Bell Operating Telephone Company. The principal cost to us—and to our customers—is the moderate expense of reconditioning, as opposed to the far more costly purchase of new frames. This process can be repeated several times within the life-span of the same equipment.

This Western Electric service also saves the company and its customers a great deal of money. This year, for example, we will be able to meet 40 percent of our growth requirement in one major type of telephone frame equipment with just such reusable equipment. That figure will jump to 60 percent next year and to 70 percent in 1980.

Western Electric also makes it possible to "retrofit" new technology as it comes along—adding a new feature to existing equipment so that we can deliver the newest and most technically efficient service to our customers.

The first of our Electronic Switching Systems—called the No. 1 ESS—was designed to serve large communities. When the needs of a community grow beyond the capacity of the machine, what can we do about it?

One solution would be to build, side-by-side with the existing system, another identical machine. That's expensive. A better solution comes from planning for just such situations: a retrofit modification.

Bell Laboratories designs equipment that Western Electric can build so that it can be modified to meet changing conditions—in this case, increased size. In the instance of the No. 1 ESS, add-on equipment, called a "One-A processor," is used to augment the original machine. By so doing, the capacity of our original switching equipment is doubled at a cost of less than half what we'd pay for an entirely new office. And added to that is the savings that comes from not having to build an expensive addition to the switching center building. New technology of this sort doesn't just happen.

Other witnesses have described the "super switcher" we call the No. 4 ESS and how the Bell partnership made possible its design, rapid development and manufacture. But I can tell you about the value of the system partnership from the operating side when such new technology becomes available. Just this year Long Lines put into service their second No. 4 ESS office in Chicago. This required major changes on an elaborately coordinated basis. Western Electric forces teamed up with ours to rearrange 9,360 existing toll connect trunks for 130 central office machines dispersed all over the state. All of this had to be cut over simultaneously to the new system without interruption to the network and to customer service.

I consider—and I think most people in America consider—the nationwide telecommunications network a vital national resource. It's the network that helps make possible the kind of telephone service Americans enjoy. Pick up your phone and in a matter of seconds you can talk to anybody else in this country or Canada or to millions of others around the world.

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Messages originating from various kinds of customer equipment must be switched through the network by various types of central office equipment, carried by various types of transmission facility, switched by other offices of various types and finally received by a telephone terminal device that may be different, too. Many calls must be switched more than once; different transmission systems must interface with each other; and many kinds of auxiliary equipment connect to the network to perform various functions. The introduction of what might appear to be a relatively simple auxiliary service often requires great ingenuity to ensure that all of the facilities involved in providing the service are compatible with every other part of the network.

We take this great technological achievement for granted. Yet it's the future of this vital national resource that's threatened by the notion that Western Electric ought to be divested.

Should we take such a risk at a time when our Nation is so concerned about its leadership in technological innovation? Those of us who are responsible for delivering service to telephone customers have to rely on new technology. To serve well, we have to encourage innovation in manufacturing. And we need the product design work which the Bell Laboratories does for Western Electric.

My twenty-five years with the Bell System have made it clear to me that every aspect of Western Electric's partnership with the Operating Telephone Companies touches the telephone customer directly. If Western Electric is split off, our customers are going to pay a great deal more for telephone service. Surely the new owners of Western Electric would have them charging the highest possible prices, making the greatest possible profits by selling all kinds of products—and not just communications products—to customers all over the world rather than being responsible as they are now for meeting Bell System needs for the best, most economical communications equipment.

Western Electric could no longer maintain the kind of cooperative production scheduling it does for us now. Today, we save a great deal of money from Western Electric's willingness to prepare for manufacture of equipment far ahead of our demand for it. That also means we won't have a long wait for delivery when we need it. I can't picture any non-obligated manufacturer being willing to take the risk of gearing up for production until dead certain that our order was coming—and coming soon.

What will happen in times of emergency?

What will happen if another central office fire takes place?

What will happen when a hurricane hits or a flood ravages, how long will it take to restore service?

And who can predict our future civil defense needs?

I'm sure that were Chicago to need telephone equipment in a hurry no non-integrated manufacturer would be able or willing to take it from some other customer's order and send it to us without significant cost penalties. We would have to stand in line with every other purchaser, American and otherwise. And meantime Illinois customers would be without telephone service.

I have tried to outline some of the advantages of Illinois Bell's association with Western Electric. I have drawn on my experience of many years in the telephone business, and more recently as the President of an Operating Telephone Company.

To me, this special relationship has meant, over many years, not a casual approach to our customers' communications needs, but a total systems approach. Research and development, manufacture and supply, delivery of service—all work together harmoniously to serve our customers. Call it vertical integration, if you prefer. I call it good business. I call it a blessing to the consumer.

This special relationship means that we at Illinois Bell and our customers get the best there is to serve their needs. Because the systems approach to their needs relies on fast and creative technical innovation, on quick delivery, on reliability under all conceivable conditions and in any emergency.

My discussion here has dealt with the past and with the present. The happenings that I have talked about are history, and the equipment to which I referred exists.

It is, however, with the future that I am concerned and it is toward consideration of the future that I have intended my remarks to be directed. To some people the word "innovation" may be an abstract notion. To me it is very real, a concept with which we at Illinois Bell are very familiar. The first No. 4 ESS, the largest and most advanced electronic switching system of its kind for long distance connections, was installed in Chicago in 1976. Illinois Bell also took part in the first commercial offering of Picturephone® service. Our company has just been involved in the highly successful operational tests of lightwave communications, a development that has tremendous potential for use throughout the nationwide network. And the first phase of a service trial of our Advanced Mobile Phone Service began in Chicago on July 1 of this year. This high-capacity system could provide higher-quality mobile service at lower prices to as many as a million people in a given metropolitan area.

Each of these dramatic new developments, and a host of others, are being introduced efficiently and effectively by the integrated Bell System. If that system is dismembered, if Western Electric is divested, what organization in the future will lead the way in bringing about such changes? What organization will have the capability? Certainly not Illinois Bell, or any other Operating Telephone Company.

We all have a great deal to lose if Western Electric is split off from the Bell System. It would have a devastating effect on the integrity of the nationwide telephone network by interrupting the efficient process of research, design, development, manufacture, and delivery of service. In fact, everyone would lose: our customers, by paying more for their service; research, by fragmenting it from the manufacturing process; the telephone companies, by depriving them of operating flexibility; and the Nation itself, which would lose a leader in technological innovation.

Simply stated, divestiture of Western Electric from the Bell System would adversely affect not only the high quality and reliability of telephone service provided by the nationwide switched network, but would place an unnecessary added cost burden on American consumers, as well. These are the irreversible consequences of divestiture.

For the many reasons I have stated, I can do no less than completely agree with Charles Zielinski, Chairman of the New York State Public Service Commission, who told this Subcommittee on July 27 that over the years, the Bell System has developed impressive evidence that vertical integration results in better, lower-priced service at higher levels of productivity. And, he added, that since the proposed Communications Act of 1978 favors full-scale competition, there seems to be little point in breaking a tie that would pose no real threat in the near future.

I agree. There would be no point.

And so, as others before me in these hearings have suggested, I recommend to this Subcommittee that Section 333 be deleted from the proposed Communications Act of 1978. □

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UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications

Statement of
Edward Goldstein
on behalf of
American Telephone and Telegraph Company

August 8, 1978

In my testimony today I would like to elaborate on some of the possible advantages and disadvantages to the public of Section 332—at least as we interpret it. I stress that point because, as I am sure the Subcommittee members and staff recognize, the wording of Section 332 can be subject to different interpretations.

I am sure you will also agree that Section 332 does not stand alone, and that it must be analyzed to some degree in the context of other provisions of the bill. That I also propose to do during my brief comments.

Finally, I will offer our views on the modifications or refinements that we think are required in Section 332 and related sections in order to assure the full participation of common carriers in the provision of efficient, versatile, and economical service to the public.

I thought it would be helpful to the Subcommittee if I began my testimony by looking at some of the far-reaching implications that Section 332 could have on the way in which residential, business and government users of telecommunications are served in the future.

I will try to do so, however, from the user's point of view. Through our various studies of users' needs we have, I believe, acquired a reasonably accurate perception of that viewpoint. Certainly, it is important that we understand the users' needs, because in the competitive and technology-rich marketplace of the future only solutions that meet users' needs can hope to prevail.

Obviously, much has changed in the communications marketplace since the Communications Act of 1934 became law. Technological changes have brought about many new services at relatively lower cost. I might add, parenthetically, that the Bell System has been instrumental in bringing about many of these changes. These technological changes, coupled with regulatory and structural changes in the industry, have worked to give telecommunications users more choice than ever before.

For example, residence customers can

choose among decorative telephones from many vendors. They can choose among many different models of telephone answering machines and automatic dialers—again from many vendors. Just beginning to appear is a great variety of electronic adjuncts and enhancements to telephones — displays of dialed numbers, timers, automatic charge computers, and so on. Moreover, the literature is full of planned systems that will couple the telephone to home computers, home television sets, household appliances, and so forth.

Business and government users, especially the larger ones, have even greater choice. They can choose among a variety of switchboards and key telephone systems. They can choose among hundreds of different data terminals and data sets. They can obtain from several suppliers digital or analog transmission channels of different band-widths or data capacities. They can configure private transmission and switching networks for voice, data, graphics, and broadband television communications needs.

Users—residence, business, and government—have become sophisticated and demanding. Many of our business customers, for example, have given responsibility for their communications to specialists who have come up through the data processing system disciplines. These users know what they want and insist on getting it.

From our studies of the needs of residence, business, and government communications users, we have reached certain conclusions that I would like to share with you.

With respect to residential users we have found that, while there are some basic communications needs that are common to all, there are identifiable categories of residential users with specialized needs. Many users, particularly the elderly, have expressed a need for more rapid, more certain access to police, fire departments, and medical emergency facilities. Working mothers have expressed interest in communications especially tailored to their need for keeping in touch with their children during the working day.

The ever-increasing cost of energy has given rise to the need for remote monitoring and control of energy use in the home. Electric utilities would like to be able to control peak loads by cycling certain appliances, such as air conditioners and hot water heaters, during peak load periods. They would also like to be able to read energy meters remotely, or to send signals into the home when off-peak rates apply.

The print media see a need to offset their spiraling printing and distribution costs by being able to distribute information to the home electronically. Educational institutions, beset by rising costs and dwindling enrollments, are looking for alternative ways of reaching into the home for additional customers for their product.

All of these needs, and many more, can be satisfied using the ubiquitous telephone network coupled with computer technology in central offices and on the customers' premises.

When we look at the needs of business and government users we find a significant shift in the way these users themselves look at telecommunications. They recognize that, while tremendous strides have been made in applying technology to improving the productivity of their manufacturing operations, an increasing proportion of their total costs is going into administrative functions. They see administrative costs rising almost out of control. As much as 50 percent or more of these costs are, in one way or another, spent on communications, including travel, letters, telephone calls, message transmission, etc. The solution they see is the substitution of electronic telecommunications for people-intensive communications activities such as travel and mail. The reason such substitution makes sense now, and will make even more sense in the future, is that electronic telecommunications costs are either decreasing or rising much more slowly than personnel costs.

We also found in studying the needs of business and government communications users that many of them are looking for "system" solutions to their communications problems. By "system" solutions I mean two things: the integration of various modalities of communications to achieve long-run economies and increased flexibility, and the provision of complete communications systems designed integrally as opposed to the stringing together of pieceparts.

When we look at existing and emerging technologies of telecommunications, we can identify three interrelated trends.

The first is a trend toward digitalization of communications. Data used by computers is, of course, inherently digital. But what is happening increasingly is that inherently analog modes of communications can also be efficiently expressed in digital form. Thus, many transmission systems now handle voice itself in digital form. Graphic information, and even live television signals, are increasingly being transmitted in digital form.

The second technological trend is that information in digital form can be very effectively and efficiently processed by digital computers. By this I do not mean data processing as the term is usually understood. What I am talking about is signal and information processing for a variety of purposes. For example, once information is in digital form it can be processed in such a way that errors introduced during its transmission can be automatically detected and even corrected. The format of the transmission can be changed so that, for example, information can originate in one code format at one transmission rate and be received at its destination in a different format at a different speed. Information can also be processed for more efficient use of transmission channels. For example, television pictures can be processed so that only the changes from one frame to the next need be transmitted; the amount of transmission capacity needed for such transmission can be reduced many times compared to transmitting an unprocessed signal.

The third technological trend is that the cost and physical size of the devices that make up digital computers have been reduced phenomenally ever since the invention of the transistor thirty years ago. For example, it has been estimated that the average cost of 100,000 simple calculations has decreased from $1.25 in 1952 to half a cent in 1977—a 250-fold reduction in 25 years! The reduction in the size of computer circuitry is perhaps equally important and impressive. It has been estimated that between the early 1950's and 1977 the space occupied by a million characters of memory was reduced from about 400 cubic feet to less than 1/10th cubic foot—a more than 1000-fold reduction! This small size makes it possible to incorporate powerful microprocessors in all kinds of devices, including communications terminal equipment.

As far as we can tell, there is no end in sight for these trends.

What then do we conclude from these studies of telecommunications users' needs and of telecommunications technologies?

Our first conclusion is that emerging user needs and emerging technologies foreshadow increasingly rapid changes in the systems and devices that will be used to meet these needs for all users—residential, business, and government. We have seen rapid changes in the past few years. But our conclusion is that, if anything, the pace of change will accelerate.

Our second conclusion is that traditional boundaries between technologies will continue to erode. When essentially all types of signals — voice, data, image, television—are expressed in digital form and can be transmitted and processed by identical devices, we will not be able to distinguish between devices that handle voice and those that handle data. Furthermore, with the increasing use of time division switching — as, for example, in the Bell System's Number 4 Electronic Switching System — even the traditional distinctions between transmission and switching are eroded.

Our third conclusion is that attempts to make hard and fast distinctions between data processing and telecommunications will become even more difficult than they are at present. We can certainly identify what one might call "pure" data processing services that do not involve any telecommunications, and "pure" telecommunications services that do not involve any processing. But most of today's systems incorporate an important gray area between these "pure" extremes, involving elements of both telecommunications and processing.

In my judgment, there is no doubt that this gray area will grow in the future. An integrated circuit processing a stream of pulses will not know whether those pulses represent voice or data, whether the process is transmission or switching, or whether it is preparing a telephone bill or performing transmission error correction.

A fourth and final conclusion flows inevitably from the preceding three. It is that there should not be any arbitrary legislative or regulatory prohibitions of the use of technology to provide what telecommunications users will need and what this rapidly changing technology will be capable of providing.

If such prohibitions are applied to all providers, society will obviously suffer. But if they are applied selectively, e.g., only to common carriers, society will still suffer because it will not enjoy the potential contributions of those who are excluded. Furthermore, there will be created inequitable competitive handicaps for those to whom the prohibitions are applied selectively.

As we have already stated, we don't think there should be any arbitrary exclusion of carriers from offering the widest possible variety of telecommunications and telecommunications-related services.

The question is: Does Section 332, as presently written and in the context of the rest of the bill, provide sufficient assurance that will not happen?

Section 332 has been widely interpreted as permitting AT&T to offer a variety of new services which it is now precluded from offering by the 1956 Consent Decree. Much of the basis for this interpretation is the Subcommittee Staff document, entitled "Major Points of Title III — Common Carrier Telecommunications," which contains the following statement:

Allows any carrier to provide any service which the Commission finds to be telecommunications or related to telecommunications through a separate company (thereby taking AT&T out from under the restraints of the 1956 Consent Decree).

We assume that the "restraints" this excerpt mentions are those that at present, with certain exceptions, prohibit AT&T from offering services other than "common carrier services," i.e., services the charges for which are, or in certain circumstances would be, subject to regulation.

We certainly have no quarrel with the intent of this provision. As the Committee knows, a number of regulatory commissions, including the FCC, have considered the so-called deregulation of communications terminal equipment. Such proposals have created a quandary for us. On the one hand, we are conscious of the difficulties which regulation causes us in an increasingly competitive marketplace for terminal equipment. On the other hand, we are also conscious of the fact that under the provision of the 1956 Consent Decree, deregulation of a class of service offerings might be interpreted as barring us from offering that service. Thus, to the extent that Section 332 would remove the threat of our being unable to offer a telecommunications service simply because a regulatory commission has declined to regulate it, we welcome it.

But at the same time, when we read Section 332 in the context of some of the other provisions of this bill, we begin to wonder about its likely or possible effect. Let me explain why.

The first sentence in Section 332 permits us

to hold or acquire shares of any separate company which engages in any activity, pro-

vides any service, or offers any product which the Commission . . . has determined to be telecommunications or to be incidental to telecommunications.

We are, of course, permitted to own separate companies today; so, there's really nothing new in that aspect of Section 332.

What we assume is intended to be new is permission for AT&T to own separate subsidiaries which may offer services that are not regulated or subject to regulation. With certain exceptions, the 1956 Consent Decree would prevent us from doing this today.

This permission, however, does not extend to all possible services. It extends only to those "services . . . which the Commission . . . has determined to be telecommunications or incidental to telecommunications."

And there we see some problems.

Section 103(23) of the bill defines "telecommunications," although not very clearly. For example, we are not sure whether it includes communications terminal equipment, or even switching.

As far as we can tell, the phrase "incidental to telecommunications" is not defined anywhere in the bill.

But perhaps there's really no point in looking for clear definitions of these terms. Because what Section 332 seems to say is that these terms mean precisely what the Commission "determines" them to mean—no more, no less. The second sentence of Section 332 gives some guidance to the Commission:

In determining whether an activity, service, or product, is telecommunications or incidental to telecommunications, the Commission shall consider whether its performance by an affiliated company is consistent with the purposes of this part.

We assume that the "purposes" referred to here are those listed in Section 331.

As we interpret Sections 332 and 331, taken together, the Commission may classify any service as not being "telecommunications or incidental to telecommunications" simply by determining that the service violates any of the "purposes" listed in Section 331. For example, it might determine that some data communications service would "limit competition," and thus should not be classified as "telecommunications or incidental to telecommunications."

There is one other section of this bill which has some relevance to Section 332, and that is Section 311.

That section gives the Commission authority to "exempt any of the classes [of interstate telecommunications services] from any requirement of this title."

The way I read Section 311 is that the Commission could, in effect, "deregulate" any service or class of service. Such deregulation could, under some interpretations of the 1956 Consent Decree, effectively prevent AT&T from providing it.

Let me tie all of this together. In order to do that, I'll make some assumptions based on an admittedly pessimistic, but not necessarily unrealistic, interpretation of the various provisions of this bill.

Assume that the Commission has chosen, under the authority of Section 311, to exempt a certain class of data communications services from regulation under Title III. Assume that AT&T has developed a service that falls into this class.

Assume also that the 1956 Consent Decree is interpreted in a way so as to prohibit AT&T from offering that service. Under Section 332, AT&T could come before the Commission and request that it be permitted to set up a separate subsidiary to offer that new service. But suppose that in this case certain vendors of data communications equipment and providers of data communications services claim that AT&T's entry into that market would "limit competition." Suppose also, that the Commission finds merit in their contention and decide that AT&T's providing this new service would not be "consistent with the purposes" stated in Section 331. The Commission could then simply determine that the new service is neither telecommunications nor incidental to telecommunications, and refuse authority to AT&T to offer the service.

I would suggest to you that under this

interpretation of the bill and the 1956 Consent Decree, H.R. 13015 could give the Commission power to prevent AT&T from offering certain services, which far exceeds the power the FCC now has.

The situation I have described stems primarily from the extraordinary amount of discretion that the bill gives the Communications Regulatory Commission (CRC). Not only could this broad discretionary power keep carriers from offering new and useful services, but it also creates uncertainties that could make it practically impossible for carriers to do the planning and preparation necessary to bring new services into being.

Now, I don't for a minute believe that this is what the Subcommittee intended in H.R. 13015. On the contrary, published statements by your Chairman and members of your Staff would lead me to believe quite the opposite. I must assume that you intended to remove roadblocks to the offering of innovative new services to meet the burgeoning needs of users of telecommunications which I alluded to earlier.

We believe that the Congress will need to circumscribe the authority of the proposed CRC. For example, we believe that the CRC's authority to, in effect, "deregulate" telecommunications services needs to be limited. We also believe that Congress should adequately define the terms "telecommunications" and "incidental to telecommunications" in the bill, rather than allowing the Commission to define them on a case-by-case basis. Finally, we believe the bill should make it clear that carriers will not be prevented from offering a telecommunications service or a service related to telecommunications simply because such a service might contain some elements that could be considered data processing.

It is not our intention that there be no bounds on the services carriers should be permitted to offer. We do not intend, for example, to open data processing service bureaus. What we are trying to suggest, however, is that this legislation recognize the technological realities of 1978 and the foreseeable future.

Among these realities is the fact of an extremely contentious boundary between telecommunications and data processing. In the absence of a clear legislative mandate to the contrary, this fact will lead to interminable—and entirely unnecessary—wrangling as to what constitutes telecommunications or data processing. The business we want to be in is the business of furnishing telecommunications services and services that are related to telecommunications. We want to be able to furnish complete telecommunications systems to our customers. Such systems will sometimes inevitably involve some functions that one might at least argue constitute data processing. Such arguments may be unavoidable under the Communications Act of 1934, but surely they ought not to be necessary under the Communications Act of 1978.

Let me now go on to another issue raised by Section 332.

On its face, Section 332 appears to be permissive with respect to carriers owning all or parts of separate subsidiary companies. On the other hand, published reports as well as the Staff document I referred to earlier seem to make it mandatory to offer certain services only through separate subsidiaries. It is not at all clear just what kinds of services are supposed to be offered only by subsidiaries and which can be offered by the parent. Neither is it clear whether a separate subsidiary is supposed to offer only a single service (however that might be defined), or whether such a subsidiary may offer several such services.

One reading of the Section suggests that the Subcommittee may have intended that all services that are determined to be telecommunications or incidental to telecommunications, but not regulated by the CRC, be offered only by separate subsidiaries.

If that is a correct reading, it raises a number of concerns.

We are not opposed to the creation of separate subsidiaries per se. After all, the Bell System today has several subsidiaries. We are concerned, however, about the creation of unnecessary subsidiaries.

Separate subsidiaries require separate staffs, and these cost money. They also create additional organizational interfaces which can impede efficient communications and decision making. One has to weigh the additional costs of these functions and the possible inefficiencies against the benefits that result.

We are not certain just what benefits are supposed to come from the requirement for separate subsidiaries. But we assume that the principal benefit expected is the elimination of cross-subsidies that some have alleged to exist between various services offered by the Bell System.

These allegations of cross-subsidy fall into two major categories. The first contains those cases where certain directly attributable costs have been alleged to have been excluded from the costs of a service. The second contains those cases where the cost of jointly used plant is alleged to have been improperly allocated to a given service.

The problem, of course, is that the Uniform System of Accounts (USOA) that has been prescribed by the FCC for use by telephone companies was never designed to attribute costs to individual services. I should add that this is not the case with Western Electric's accounting system, which can provide a precise breakdown of costs.

AT&T has undertaken the development of a new accounting system, called Functional Accounting, which will give much more detailed and categorical information than is now provided by the USOA. Initial phases of that system have been introduced in some Bell Operating Telephone Companies, and eventually all of the companies will be using it. The FCC has also recently announced a rulemaking proceeding leading to a revision of the USOA. In addition, the approval of some new services such as our Digital Data Service offering has been made contingent on the creation of a detailed Cost of Service Record System, which is in the process of being developed.

The culmination of all of these efforts —Functional Accounting, the revision of the USOA, and the creation of interim Cost of Service Record Systems—should make it possible for the Commission to identify all costs that are directly attributable to a service, and to ensure that all these costs, as well as any additional costs that the Commission may determine, are reflected properly in the price charged for the service. Thus, there would not be a need for a separate subsidiary simply for the purpose of assuring the correct attribution of these costs to a service.

With respect to the allocation of the cost of jointly used plant, the situation is more complex. There is no single right way to allocate joint costs. All such allocations are, in one way or another, arbitrary. And separate subsidiaries do not offer a solution to this problem. One can, of course, resolve the problem by not using any plant jointly for two or more services. But one pays a stiff price for that simple solution. The reason plant is used jointly in the first place is that such joint use is more economical than provision of separate facilities for each service. This comes about through the very substantial economies of scale that exist, especially in the provision of transmission facilities. It would not make sense to lay separate cables for each separate service that is provided by the telephone company. It would not make sense to build a separate microwave system, with separate towers, for each separate service. It would not make sense to build a separate building to house separate switching machines for separate services. The cost to users of telecommunications, and to society as a whole, would be far in excess of the presumed benefits that might be gained by an arbitrary prohibition of joint plant use by more than a single service.

If joint use of telecommunications facilities is in the best interest of users and society, then what purpose would be served by having separate subsidiaries? If a subsidiary used plant jointly, either with its parent or with another subsidi-

ary, there would still have to be an allocation of these joint costs to the subsidiary. This would require an accounting system and some methodology for allocating joint costs. But given such accounting systems and rules of allocation, these could be applied without the need for a separate subsidiary.

The point I have been trying to make is this: If the purpose of setting up separate subsidiaries is to prevent cross-subsidies, that purpose can be met more effectively by properly designed accounting systems and agreed upon rules for allocating joint costs. As I have pointed out earlier, the design of such accounting systems is well under way, and their adoption is now the subject of FCC rule-making proceedings.

But let me say that, if it is necessary for us to form separate subsidiaries in order to offer the various services discussed earlier, we are prepared to do so.

If we assume that there are certain services that can be furnished by us only through separate subsidiaries, there is another concern.

As I mentioned earlier, users see increasing needs for system solutions. Many of them do not want to "piece out" their own systems but would like to look to a single supplier to provide them with complete service. In that way they can be assured of compatibility among all of the pieces that make up their system. They can hold a single vendor responsible for the system's operation. As changes are necessary, they can look to a single vendor to engineer these changes, to coordinate their implementation, and to take responsibility.

What concerns us is the possibility that the setting up of separate subsidiaries, each furnishing a piecepart of complete systems, would deprive users of the advantages of being able to deal with a single, totally responsible supplier.

Whatever plan is adopted, we believe that provisions must be made to permit a single point of contact for the Bell System's customers in their dealings with the Bell System. It would not be necessary for all customers to deal with the same point of contact. For example, all residence customers could deal with one organization, while business and government customers deal with another. And, of course, there should be the possibility for some geographic lines of organization. What is important is to ensure that any given customer does not have to piece out his system from various Bell subsidiaries, but can deal with a single agency to obtain, manage, and maintain his complete system.

The last issue I would like to bring to the Subcommittee's attention is one more fully dealt with by Dr. Tanenbaum, but one that has considerable relevance to the issues which I have been discussing. And that is the issue of vertical integration.

As we interpret Section 331, and especially subparagraphs (1), (3), and (4), the Subcommittee wishes to establish "full and fair competitive conditions." Under the provision of Section 332, at least some competitive services, perhaps those that are not regulated, would have to be furnished through separate subsidiaries. At least, that is our reading of Section 332.

Included among such services could be telecommunications terminal equipment and certain data communications services. There has, of course, been competition in those areas ever since Carterfone, and in some cases before then. The competition is strong and becoming stronger. In the area of PBX's, for example, there are firms like Northern Telecom and ITT. In the area of data terminal equipment I need mention only IBM and Digital Equipment Corporation. All of these firms are vertically integrated. They have strong research and development and manufacturing capabilities and very strong field sales and maintenance organizations.

In a competitive marketplace, especially one that is as volatile technologically as the telecommunications terminal equipment and data communications areas, vertical integration is absolutely necessary in order to be able to compete

successfully. Only vertical integration permits vendors in this marketplace to be responsive to fast-changing user needs and to emerging technologies.

There obviously cannot be "full and fair competitive conditions" if the Bell System is expected to compete against vertically integrated competitors without itself being vertically integrated.

You have been very patient. Let me quickly sum up the points I've been trying to make.

The telecommunications business is a dynamic and fast-changing business. We foresee many new services that will be directed at the satisfaction of the user needs I spoke about at the beginning of this statement. There will be services that will permit remote energy management for residences and businesses. In the area that is often called "office automation" there will be sophisticated telecommunications services containing many different aspects of information processing. Electronic Funds Transfer Systems of various types will be available. New alarm and security services will incorporate sophisticated communications. The list of telecommunications services and telecommunications-related services now being developed goes on and on. But, more important is the fact that there will be emerging during the life of this bill many more services that we cannot even imagine as yet.

We strongly believe that any new legislation should make it clear that carriers will be able to participate in the emerging new applications of telecommunications without arbitrary, technology-related constraints. In particular, it should be made clear the carriers will not be precluded from offering an otherwise admissible service simply because that service contains some elements that could be classified as data processing.

We believe that the legislation as now written gives the Commission extremely wide latitude to prevent carriers, and especially the Bell System—because of the 1956 Consent Decree—from offering a variety of services it might wish, for any reason to "deregulate." We believe that such latitude is not appropriate and should be modified.

We also believe that Congress should not call for the creation of unnecessary subsidiaries.

We believe that if subsidiaries are required to offer certain services, any particular customer or group of customers should be able to deal with a single point of contact to obtain all Bell System services—regardless of whether they are furnished by the parent or any of its subsidiaries.

In addition, if one wishes to rely on competition to provide efficiency, innovation, and low rates, and to determine variety, quality, and cost of telecommunications services, we believe that it should be made very clear that you intend the Bell System to play its appropriate role in achieving these objectives.

Finally, we strongly believe that the "full and fair competitive conditions" that are called for in Section 331 can be achieved only if the Bell System, like many of its major competitors, can remain vertically integrated. □

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UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications

Statement of
Richard B. Nichols
on behalf of
American Telephone and Telegraph Company

August 14, 1978

International Telecommunications: Prospects and Performance

These proceedings come at an important time in the evolution of the international network. As we look ahead to the decade of the Eighties and beyond, the opportunities and the need to serve the public are increasing as never before.

The technology – including satellites, high-capacity cables and ultimately fiber optics—offers capabilities unimagined even a decade ago.

As an example of this continuing evolution, last month we and our foreign counterparts began implementing a new signaling system. In addition to reducing the time it takes to complete overseas calls, it gives us the advantages of improved circuit utilization and increased technical capability.

Furthermore, it is now possible for customers to dial direct to any of 47 countries from about one-third of U.S. telephones. By 1980, more than half of America's telephones will be equipped for direct dialing to more than 80 foreign countries.

As these improvements enhance the ease and convenience of international calling and reduce its cost, other developments are occurring which underscore their importance.

First, the dramatic increase in overseas calling continues unabated. In 1977, for example, we handled more than 110 million overseas calls as compared with 1 million in 1950. The U.S. growth rate, as you know, is averaging about 25 percent annually. But international calling generally is soaring, reflecting the growing interdependence among nations.

A second key development is the growing commitment by industrialized—and developing—countries to improve the quality and expand the scope of their telecommunications services. These countries are spending billions of dollars to construct new facilities and—in several instances—build nationwide communications grids that never existed before. The United States network, by the way, is

often seen as the model to emulate in these efforts.

These developments foreshadow great progress in international telecommunications. But they also serve to remind us that, with all that is occurring worldwide, the United States has no absolute guarantee that it will retain its historic, preeminent position in telecommunications.

That, in my view, is why these proceedings—and the Subcommittee's initiatives for so many months—are crucial. In deciding public policy for the future, I believe it is imperative to avoid dismantling the technical and structural framework through which so much progress has been attained in the past.

That progress is easily measured. We have accommodated extraordinary growth in calling volumes. We have improved service to the point where calling many points abroad is about as easy—and sounds as good—as calling your neighbor across the street. Rates have been reduced, despite inflation, so that calling overseas today is not a luxury but within the means of most Americans.

At the same time, we have innovated. We have introduced high-capacity undersea cables and satellites which have dramatically reduced costs and improved our way of doing business. And exploratory work is now in progress on fiber optic cables which could provide still greater economies and service improvements.

These significant improvements in service and technology have been achieved through a worldwide structure that—while not perfect—is unique. It involves, in effect, a cooperative effort between American carriers and their foreign counterparts to provide quality service to the public.

AT&T's role is largely to provide long distance telephone service between the U.S. and overseas points. Other American service carriers—the international record carriers—provide telegram, telex and most private line services. The Communications Satellite Corporation (Comsat)—as a "carrier's carrier"—provides satellite facilities to AT&T and the international record carriers for their use in providing service to customers.

The AT&T partnership with foreign administrations in providing international telephone services has, in my view, worked exceptionally well over the years. There is mutual respect, accommodation and appreciation of each other's concerns and national problems. And—most important—there is close coordination and planning to ensure that the right mix of satellite and cable facilities are available at the right time to provide reliable and reasonably priced service to the public.

In developing international telecommunications policy, it is important to keep in mind both the similarities and distinctions between domestic and overseas communications.

From a technical and operational point of view, domestic and international telephone communications cannot be separated. The two are inextricably linked. Since they use the same network, they must be provided, and managed in a consistent manner.

However, from a political point of view, they are fundamentally different, and must be treated differently. Regulatory policy must recognize that any decision reached on this side of the ocean must be agreed to by independent parties on the other side, who share in the ownership and control of the connecting facilities.

Overview of Testimony

With that as a backdrop, I'd like to turn now to the specifics of this legislation. I have three basic reactions.

The first is very positive. I strongly support the Subcommittee's efforts to resolve what is clearly the key issue in the international arena, namely, the planning and approval process for the construction of facilities used to provide international telecommunications.

The process you propose could very possibly remove the roadblocks that have inhibited and frustrated the efforts of American carriers and our foreign part-

ners to plan and implement adequate international facilities and maintain a reasonable balance of available technologies.

My second reaction is negative. I am strongly opposed to the way this bill would restructure the international telecommunications industry. I am particularly concerned about introduction of multiple suppliers in international telephone service. A system of multiple suppliers cannot be implemented without the cooperation of foreign partners.

The imposition and interconnection of multiple carriers for the provision of international telephone service is wrong both technically and politically. It would pose enormous technical problems that would increase the cost and impair the quality and convenience of international calling, without achieving your objective of true competition.

What's more, it would disrupt delicate relationships with foreign telephone entities—who, of course, are not subject to the directives and wishes of this Congress or its regulatory agencies. A major flaw of this portion of the bill, in my view, is that it fails to adequately recognize some of the inherent political differences between domestic and international communications.

My third reaction is somewhere between the first and second. It has to do with the ambiguity and, in some cases, apparent inconsistency in the language of certain sections. Some of these problems can be remedied easily. Others, however, such as the lack of any identifiable public interest standard, are much more troublesome.

Overall, though, I think the international section of this draft represents a significant step forward by the Subcommittee and its staff to provide long-term solutions to the needs of the carriers and, more importantly, their customers.

Now that you know where I stand generally, let me get more specific.

Facilities Planning and Construction

I believe there is general agreement that of all the issues related to international service, legislative solutions are needed in the area of facilities planning more than anywhere else.

The central problem has been regulatory resistance to efforts by U.S. and foreign carriers to provide a diverse, reasonably balanced mix of international cable and satellite facilities—a mix that will ensure not only cost-effectiveness but also service reliability.

This has resulted in costly delays—and sometimes indefinite deferrals—in the construction and implementation of submarine cable systems. Several factors have contributed to these delays:

- The constant opposition of Comsat, an entity dedicated solely to optimizing a single technology.
- Limited oversight of Comsat in the commitments it makes to INTELSAT, the international satellite organization.
- Needlessly complicating and prolonging the approval process by requiring carriers to reapply for authority to use systems for which the Commission has already granted permission to build.

These delays have increased the costs and jeopardized the investments of U.S. and foreign administrations, deferred the achievement of service goals and severely strained relationships with foreign telephone entities. In addition, they have threatened American leadership in telecommunications technology, the markets of American suppliers and the jobs of their workers.

Considering the chaos that characterizes the current scene, the need for a facilities planning mechanism is, in my view, undisputed. Whether the task force approach you outlined is the best solution, I'm not sure. But I do think the concept has considerable merit.

For one thing, it recognizes the importance of giving consideration to the viewpoints of all interested parties, including the government, all the service carriers and Comsat.

At the same time, it seeks to give the U.S. carriers and their foreign counter-

parts the freedom and flexibility to plan and implement international facilities in a balanced and timely fashion, capitalizing on the benefits of all available technology.

It also would eliminate the delays caused by present FCC approval procedures which require separate authorizations for construction and use.

Finally, this approach would give back to the carriers managerial responsibility for determining the investments they should make, while still protecting ratepayers from imprudent or excessive investments.

However, I do have some thoughts on how this portion of the bill can be improved. Basically, they cover three areas: the role of the task force, the role of the foreign administrations and rate base regulation.

Let's look first at the role of the task force. I would suggest the bill *specifically* spell out that the task force planning process is to be advisory in nature. The carriers should be allowed to implement — without unnecessary delay — facilities plans developed in cooperation with international counterparts. If they make imprudent judgments, excess investments might be excluded from the rate base through regulatory action.

I also would recommend amending, removing or clarifying the provision requiring the carriers to seek permission from the Communications Regulatory Commission (CRC) to enter into agreements with foreign administrations. Left unchanged, this could conceivably be used as a mechanism for over-regulation of the business relationships between American carriers and their foreign counterparts. Giving the CRC authority to block agreements is the same as giving it authority to block facility projects. This could lead to the same regulatory situation we have today.

Secondly, I'd like to comment on the role of the foreign telephone entities. I think it would be helpful to have specific language clearly and unequivocally recognizing the partnership nature of international communications.

This would insure that the task force gives proper weight to the views of foreign administrations, whose investments, service capabilities and national interests would be affected by any facilities decision. The failure to recognize the principle of foreign comity is the root cause of our current difficulties in facilities planning.

Finally and very importantly, I think the process specified for regulating international facility investments does not give the regulatory commission enough flexibility.

We recognize the need for regulatory oversight of carriers' investments in order to protect ratepayers from imprudent investments. However, I think the penalty provision requiring disallowance of facilities deemed to be more than 10 percent in excess of need is too arbitrary and rigid.

The CRC should have surveillance of all aspects of rate of return and rate base. However, carriers should not be penalized for events beyond their control, such as a sudden downturn in the world-wide economy or other events which would sharply lower traffic volumes.

Despite the concerns I've expressed about this section of the bill, I want to emphasize my support for the concept of facility planning outlined in this legislation. It needs some changes, but it's potentially workable.

Industry Structure

As I said earlier, I believe that trying to create competition by involving multiple suppliers in the provision of international telephone service, i.e., voice, would not be in the public interest, if in fact it was feasible.

It would do nothing to advance the progress of international telephone service. In fact, it would make international calling less convenient, more complicated and more costly for the vast majority of users—both here and abroad. In short, it would be a significant step back, not forward.

There are three basic reasons why I believe this approach is not in the public interest. The first is technical, the second financial and the third political.

First, the technical. In his July 26 testimony before the Subcommittee, Mr. (Richard) Hough outlined the complications that would ensue from having multiple suppliers of basic services in the domestic public switched network. The same would apply to the international network, which in a technical sense is essentially an extension of the domestic network.

Having multiple suppliers for international telephone service would, of course, require interconnection of all such carriers with the domestic networks—including local exchanges—both here and abroad. The limited service carriers who would be competing with AT&T would—as the international record carriers have already done—demand that their customers be treated no differently than the telephone company customers. They call this dialing parity.

Achieving such interconnection would require fundamental changes in the way telephone service is provided and in the way customers use their service. New procedures would be required for customer dialing, operator handling and company billing—not to mention the technical problems involved in interconnecting the facilities of a host of competing carriers.

Let's look at just one facet of the problem—from the customer's point of view. As I noted earlier, millions of Americans can now dial direct to any of 47 countries through a simple access code, or reach any other phone in the world by dialing 0 for operator.

Consider what would happen if, for example, two competing carriers decide to provide international telephone service on a high-volume, low-cost route such as New York to London, offering cheaper rates than the regular telephone companies. Let's assume the same thing occurs on other selected routes. Take it a step further and assume other carriers offer customers a choice of transmission systems, say satellite or cable.

Customers would have a choice of carriers to selected locations but not to others. And to some locations a choice of technology. Thus, to place overseas calls, *all* customers would have to make a number of additional decisions, each requiring different dialing or operator handling procedures.

The front of telephone directories would require detailed calling instructions, which, of course, would become out of date as carriers change or add to their service offerings. To dial direct, customers might have to dial several additional digits, including, for example, one set to access the preferred carrier and another to choose the type of service. Every overseas call would become more complicated.

Let's take a hypothetical but not unrealistic example of what an overseas caller could face.

After struggling with detailed—and possibly outdated—directory instructions, the customer gives up and dials the operator:

Customer: *"Operator, I want to call London."*

Operator: *"Yes, sir, which carrier do you prefer?"*

Customer: *"How many carriers are there?"*

Operator: *"To London, there are three."*

Customer: *"Which ones?"*

Operator (consulting this week's order of presentation):
"They are ABC, Bell and XYZ."

Customer: *"Who has the cheapest rate? Which ones use cable, which ones satellite?"*

Let me assure you this scenario is not a figment of my imagination. That is exactly what dialing parity means.

This is but one example—from the customer's perspective—of what intercon-

nection of competing carriers would involve.

The point is that a multiple carrier arrangement for international calling would create immeasurable technical problems that would increase the complexity and the cost of providing this service. And, of course, its impact on the convenience of that service would be quite evident to the customer.

Fragmenting the provision of international calling involves economic as well as technical penalties.

Splitting up traffic volumes among different carriers would lead to inefficient use of network facilities. In addition, it would make the network planning process chaotic, and it would complicate the process by which revenues are divided with foreign counterparts.

For example, here is what could happen if you had competing, non-cooperative carriers providing separate groups of trunks between the U.S. and another country.

The foreign partner would be free to route calls to the U.S. over any trunk group, while each U.S. carrier would only be able to utilize its own limited number of trunks. Since the foreign partner shares in the cost of all trunks to the U.S., he would only be interested in obtaining enough trunks to handle calls from his country to the U.S.

Therefore, he might resist a specific U.S. carrier's desire for additional trunks. In addition, he would be able to route calls to the U.S. over whatever carrier's trunks he desired. The result would be an acceptable grade of service for foreign users and increased blocking for U.S. callers using that carrier's service.

That, of course, assumes the foreign telephone entity would be willing to interconnect with several American carriers. Which leads me to the *political* aspects.

Foreign telecommunications entities are well aware of the diseconomies of splintering trunks among several carriers and may be unwilling to support the resulting financial burden. The point is, the U.S. cannot radically restructure the international telecommunications industry without the cooperation of the foreign counterparts.

Our sister nations remain convinced that provision of message telephone service by a single entity most benefits the user. The U.S. should carefully examine the consequences of making its international communications industry even more dissimilar from that which prevails around the world.

But beyond the technical, economic and political considerations is a more fundamental question: Will multiple suppliers of international telephone service result in real competition?

Mr. Hough spoke to that issue in discussing the effects of fragmenting the provision of basic switched services in the domestic network. As I noted earlier, everything he said about the domestic network applies to the international scene, but with some *additional* wrinkles.

For example, in the domestic arena, competing carriers can and do provide their own intercity facilities. However, because of the high costs involved in providing overseas facilities and the unwillingness of foreign partners to invest in duplicative facilities, competing U.S. international carriers would have to provide their services on the same cable or satellite facilities. No real differences in cost could be expected since the same facilities would be used by all suppliers.

Another fundamental reason why the multiple supplier arrangement won't produce genuine competition is that it would require the agreement and participation of the foreign telephone administrations, something that cannot be legislated or regulated.

I think we can say with some degree of assurance that they would not agree to such competition because to do so would force them to compete against themselves. Since they share revenues as well as the facilities, why should they agree to charge different customers different rates for the same service?

The plain fact is, having multiple sup-

pliers is not going to produce a competitive environment of the kind you envision. The basic elements necessary are lacking. It just won't work.

I would now like to comment on the role this bill would give to Comsat.

The proper role of Comsat was at the heart of the debates in Congress that led to the passage of the Satellite Act of 1962. The broadly supported concept of that legislation was that it would be fundamentally inequitable to grant Comsat a legislated monopoly position as a carrier's carrier with regard to INTELSAT facilities while allowing users to circumvent the service carriers and buy satellite time directly from Comsat.

Thus, the authorized user concept was formulated to balance and protect the interests of Comsat, the carriers and the ratepayers. It provided that:

—Comsat would be the *only* U.S. supplier of international satellite *facilities*;

—The carriers would not face unfair competition from Comsat in the provision of international *services*;

—The ratepayers would be shielded from unnecessary duplication of international satellite systems.

I submit that nothing has changed since then that would dictate the need to alter that concept.

I do not want to take away from the important function Comsat has and is continuing to perform. However, in examining what the role of Comsat should be in the future of international telecommunications, it is important to note a critical distinction between Comsat and the service carriers:

Comsat's reason for existing is *satellites*. Ours is service. For us, technology, in whatever form, is simply a means to an end. For Comsat, its technology is an end in itself.

A final point of concern about the industry structure is the apparent removal of the historic distinction between voice and record services in the international arena. We are not certain what the intent of the bill is in this area. However, the international record carriers certainly appear to be meeting the needs of their customers. And we find ourselves sufficiently challenged in meeting the rapidly growing needs of our customers for international telephone service. Because of this we would not urge this Congress to alter the present situation.

To sum up my position on this section of the bill, I want to emphasize one point. The unique world of international telephone service does not lend itself to fragmentation. For the U.S. to attempt unilaterally to fragment international telephone service will put the U.S. out of step with the rest of the world. The resulting incompatibility will set back the cause of global communications, to the detriment of the communications user.

General Policy Considerations

As I mentioned at the outset, there are points in this bill we support, some we oppose and others we question—because we are not sure of their intent. It is the third category I would now like to address—namely, the points that are either not clear or not covered in this bill.

Mr. (William) Ellinghaus has already stated AT&T's concern that the bill generally lacks a sufficent public interest standard to which the CRC can look for direction in balancing the interests of the average user against those of the specialized user in the bill's overall reliance on marketplace forces. He observed that, although the bill recognizes competitive forces may be "deficient" in some circumstances to assure the public interest, it apparently fails to give the CRC any criteria for policy formulation in this most important area.

This problem is compounded in the international portion of the bill, for it fails to allow for CRC discretion to regulate in the public interest insofar as multiple suppliers of *international* services is concerned. Competition is simply mandated. I submit this is a critical deficiency.

Other aspects of international telecommunications policy are difficult to discuss because we are not sure what the bill really intends. It is not clear, for example, whether the bill intends its major and controversial "domestic" innovations to apply to international telecommunications. Can the CRC classify international service and carriers into "competitive" and "noncompetitive" categories? Will the access charge and Universal Service Compensation Fund apply to international telephone service if there are multiple suppliers of that service?

There are many other instances of confusion in the bill as to the intended regulatory treatment of international telecommunications.

For example, the definitions of "domestic service carrier" and "international service carrier" are mutually exclusive. No carrier can be, under the bill, both a domestic and an international service carrier. But the reality is that AT&T is both a domestic and international service carrier. AT&T's international telephone service is provided using the same public switched network as its domestic service.

The same dilemma is presented by the definition of international telecommunications facilities and properties. The bill defines the entire public switched network—right down to the handset—as international, since it is used to provide overseas service.

Also, Title III, Part C of the bill mandates that the CRC cannot impose on carriers the compositing or averaging of rates, charges or costs of differing technologies for international telecommunications. While it appears that carriers would be free to propose compositing and averaging on their own, I suggest language be added to clarify that carriers are not *prohibited* from such compositing or averaging.

To sum up, there is a serious lack of clarity—even inconsistency—in terms of how the bill's telecommunications provisions are to be implemented.

This observation applies doubly to the bill's inconsistent treatment of international telecommunications as a subpart of Title III.

Clarification in these areas is obviously needed if the new regulatory commission is to be able to implement the true intent of Congress without endless legal challenges and delay.

CONCLUSION

Given the time we've had to study this bill, here in brief is where we come out, at least to the degree we understand the bill's real intent.

1. We strongly endorse your efforts to resolve the critical issue of facility planning. However, we suggest that:

- the advisory role of the task force be spelled out more clearly;
- carriers not have to seek Commission approval to negotiate with foreign entities;
- more recognition be given the vital partnership role of foreign telephone administrations;
- more flexibility be given to the CRC in the oversight of carriers' investments.

2. We strongly oppose the changes proposed for the industry structure, particularly the introduction of multiple suppliers in voice telephone service.

- It would pose enormous technical problems that would raise the cost and impair the quality and convenience of overseas calling for *all* users.
- It would disrupt delicate relationships with foreign countries and, of course, would not work without their cooperation.
- It would put the U.S. out of step with the rest of the world and impede the progress of global communications.

True competition in international telephone service is just not feasible.

3. We are concerned about the ambiguity of the bill on a number of key

points, in particular the absence of any public interest standard and the absolute mandate for competition.

Earlier I noted how important it is for the Congress to decide—*from the customer's viewpoint*—what is best for the future of international telecommunications.

Organizational structures, regulatory processes, facility selection, competition —these issues *are* important, and I have addressed them. But they are purely *means* to an *end*.

I submit that if the voices of overseas callers could be heard—among all the others in this proceeding—the message would be quite simple. It might go like this: "I want fast service. I want convenient service. I want a clear connection. And I want to pay a reasonable price for it."

To the extent that this process enables us to move forward heeding that customer message, I believe the journey will have been worthwhile.

I commend the Subcommittee for starting down that road. □

PART II

UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications
Field Hearings
Boston, Mass.

Statement of
John F. Prendiville
New England Telephone Company

August 18, 1978

INTRODUCTION

I will demonstrate today through my testimony on Section 333 of the Communications Act of 1978 that this structure is truly synergistic, i.e., more is derived from this structure than is put into it, and that it provides multiple opportunities for all persons within it to exchange information and solve system problems. It thus causes the widest availability of high quality communications services at the lowest possible overall cost to the public.

Contributing to this is the ability to work openly with Bell Laboratories and Western Electric in the introduction of new technology in NET's network . . . and to use the engineering services and continuing support furnished by Western Electric for its products and service.

Divestiture of Western Electric would have a ruinous effect on these advantages and would increase NET's rates to its customers.

NEW ENGLAND TELEPHONE

New England Telephone—which operates in Maine, Massachusetts, Rhode Island, New Hampshire and Vermont—is one of 23 operating companies in the Bell System. It serves 93 percent of the households in its territory—and has 3.7 million customers. The company had 40,000 employees and an annual payroll of $697 million in 1977.

Its stock is 86 percent owned by AT&T, which provides NET with advice and assistance in all facets of telecommunications operations. Through the Bell Laboratories and Western Electric, AT&T meets the operating telephone company needs for new technology and assures compatibility with older technology. This is a managerial and technical system which allows all parties within the Bell System to determine the needs for improvements and changes to meet a common objective: the best possible tele-

communications services at the lowest possible prices.

WESTERN ELECTRIC IN NEW ENGLAND

Western Electric has three major facilities in Massachusetts: two inventory and supply distribution centers in Watertown and Southboro, and a major plant for manufacturing transmission equipment in North Andover. Western Electric employs about 8,400 people at these locations. Its payroll amounted to $126 million in 1977.

While Western Electric provides NET with products and services at prices that reflect Western's economies and efficiencies in serving all of the Bell System operating companies, we are *not* obligated to purchase solely from Western Electric. We *are* obligated to purchase any product or service from whichever supplier presents us with the lowest total life-cycle cost for each product or service.

In 1977, NET purchased $19 million of equipment and services directly from suppliers *other* than Western Electric.

In addition, of the $239 million of products and services which we purchased from Western Electric, $44 million were purchased by Western itself from non-Bell suppliers.

The total Western Electric purchases from New England businesses for all Bell System companies amounted to $247 million last year.

While vertical integration does *not* deny sales opportunities to other telecommunications suppliers, it does provide a benchmark for them to meet in the lifetime support of their products.

Vertical integration does assure that innovation's benefits are efficiently transferred from design to user — and that prices are maintained as low as possible.

WESTERN ELECTRIC/BELL LABORATORIES/NET: INTEGRATION AND INNOVATION

The innovation process—guided by AT&T—reaches from Bell Laboratories through Western Electric to us at New England. A noteworthy example of Bell System integration is the Bell Laboratories presence in the North Andover transmission plant. There, about 700 Bell Laboratories personnel provided for the orderly and economic transfer of design and development information directly into the manufacturing process.

A significant measure of the extent of the Bell System's innovation is an examination of Western Electric's expected 1978 sales to NET, which shows that about 60 percent of these sales are for products whose design did not exist in 1974.

The innovation process is two-way—with feedback from NET marketing and technical people to the designer (Bell Laboratories) and manufacturer (Western Electric) to assure that they have all the information available to meet the service needs of NET's customers relating to the new technology.

On the other hand, New England Telephone holds up its end of this integrated system by planning network growth needs jointly with the Long Lines Department of AT&T and, as required, with the independent telephone companies.

These planning efforts are supplemented by direct assistance and inputs from AT&T, Bell Laboratories and Western Electric. Since all parties in the planning process are striving for common objectives, the meetings are held with no inhibitions on the free flow of information and without the impediments which would be created by the need to protect proprietary interests.

For example, recently we completed a 20-year look at the need for our intercity transmission facility network in New England. We evaluated growth predictions, technical requirements, and the available technology to design the most

economical network for the next 20 years. Today we are implementing these plans with extensive use of digital radio and digital carrier equipment. Two such links in the network now under construction are between Pittsfield and Springfield, Massachusetts, and between Lawrence, Massachusetts, and Manchester, New Hampshire.

Similar *joint* planning efforts have provided us with "blueprints" for the orderly modernization and expansion of our toll switching centers. A nearby example is the ultra-modern switching center we're installing in Cambridge for Long Lines; joint planning began three years ago, and this major switching center—using Western Electric's 4ESS toll switching machine—will be in service a year from now.

Our ability to make long-range plans for transmission and switching with confidence is based on the historical evidence that Bell Laboratories and Western Electric will furnish the new technology required to meet future needs and simultaneously keep the current equipment updated and compatible with the new technology.

In this connection I would like to cite the 1971-72 period when the New England economy was booming. At that time, it became necessary in Eastern Massachusetts to dramatically increase our network capacity for local and long distance switching. Rapid growth in both numbers of customers and their usage of the network required the expansion of the network with five additional large long distance switching centers and more than 250 installations in local switching centers. Western Electric, as a member of the vertically integrated system, met our overall commitment to service and helped implement the rapid expansion program without charging "what the market will bear" as other suppliers would be expected to do. This is typical of its response in the environment of a constantly changing dynamic network.

Another instance of our reliance on the capabilities of Bell Laboratories and Western Electric is found in our current program to ultimately equip all of NET's 683 local switching centers with electronic machines. This replacement program has a given that Western Electric's updating of older electromechanical equipment now in place will keep pace with our planned introduction of the new electronic systems. A recent example of this was the 1976 "cutover" of an Electronic Switching System center in Worcester, Massachusetts, a replacement for a 41-year-old switching office. This Worcester "cutover" was the largest one of its type in the Bell System. There are similar forthcoming "cutovers" in Burlington, Vermont, and in Concord and Manchester, New Hampshire.

A non integrated telecommunications manufacturer—motivated primarily by profit—probably would not have the same concern as Western Electric to assure the continual compatibility of newer products with the older technology, such as equipment located in other local switching centers around Concord, New Hampshire.

If Western Electric were divested from the Bell System, then NET would have to provide other resources to assure the continuing compatibility of its older with its newer technology.

The extra costs of these resources would undoubtedly result in higher rates for our customers.

I am personally convinced that the vertically integrated system today provides for the orderly introduction of technology's benefits at the lowest costs to New England Telephone and to its customers.

SUPPORT

Today's new electronic technology requires real-time assistance to solve occasional problems which affect customers served by electronic switching centers.

I was recently involved in an example of this support. An after-hours call from our Portland, Maine, electronic switching center indicated they were concerned about an intermittently occurring slow dial tone problem. Contacts were made

with Western Electric's Project Engineering Control Center (PECC) located at Indian Hill, Illinois. Through data communication links established between the Portland office and the resource at Indian Hill, the PECC people in Illinois were able to survey the Portland Center's operation and after comprehensive analysis found the problem. The problem was corrected, and potential service interruptions precluded. Such PECC's are located at the major product line manufacturing plants of Western Electric or are co-located with designers at Bell Laboratories locations. For example, a PECC transmission resource is available at North Andover to assist Bell operating companies with digital carrier problems.

Western Electric also responds expeditiously to our needs in *unique* ways. In 1975, its engineers located in Newark, New Jersey, and Denver, Colorado, designed a Centralized Attendants System (CAS) for a large Boston retail store and its 10 New England branches—Jordan Marsh—to handle its customers' requests for service and information. Calls to the branch locations are routed via CAS equipment to attendants located in Boston. Customers are then transferred to the appropriate department and store. This design met all requirements of our customer and is now in service, using the latest electronic switchboard. As a result of this interaction, the design is now a standard offering for Bell System customers nationwide.

A "NON-CRISIS"

As I have demonstrated, vertical integration provides the framework for a telecommunications system that works well. The Bell System has proven this many times in the past by demonstrating an extraordinary ability to restore service when massive disruptions have been caused by natural disasters. The record of the Bell System is replete with such documented examples, from the New England hurricane of 40 years ago next month to the recent floods in New Orleans. But, in my opinion, the most persuasive testimonial to the advantages of vertical integration is found in the evidence that our telecommunications system operates efficiently even when the environment around it is in a "state of crisis."

Last February 6 and 7, the "blizzard of the century" dumped over 27 inches of snow on eastern Massachusetts and Rhode Island. Wind velocity peaked at 69 miles per hour in Boston and 92 miles per hour at the Chatham, Massachusetts, weather station. Tides were measured 16 feet over normal levels. Over 3,500 vehicles were stranded for some time on Route 128 alone. The damage from this storm was estimated to approach $1 billion.

Governor Dukakis of Massachusetts declared a state of emergency in eastern Massachusetts and banned nonessential vehicular traffic from the highways. A similar declaration was made in Rhode Island by Governor Garrahy. And both areas were declared federal disaster areas by President Carter. Throughout the blizzard and the week of recovery which followed, the NET and Long Lines network experienced extremely heavy calling. While there were some understandable delays in dial tone and call completions, the network performed superbly. Emergency engines supplied power when commercial power was lost.

Our telephone network control center at 185 Franklin Street, Boston re-routed telephone messages around congested locations by using software programs which were resident in the network administration system's minicomputers.

Our telecommunications network in New England had a "*non-crisis*."

It was a superb demonstration of the end results of the vertical integration of Bell Laboratories design, Western Electric manufacturing and supply, and NET/Long Lines operations working as planned. The lack of publicity concerning telecommunications confirms that government officials were able to manage and control vital state, municipal, food, fuel and other essential functions during

this time of crisis in the external environment.

CONCLUSION

In summation, it is my belief that vertical integration has enabled NET to provide top-quality telecommunications service at the lowest possible cost. The system works well! Why cripple what works so well for the customer? □

UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications
Field Hearings
Chicago, Illinois

Statement of
R. Douglas Watson
on behalf of the
Central Area Long Lines
Department of American Telephone and Telegraph Company

August 22, 1978

Other Bell System witnesses have already testified about how divestiture of Western Electric would adversely affect both service and prices to the telephone customer. They told you how divestiture would be devastating to the nationwide switched network. There is no need for me to repeat their testimony. But I do want to reinforce it, and to let you know that I, too, am very concerned. My concern springs from what I know firsthand about the network, because I am responsible to our customers for its service performance in this part of the country. I know what the integrated Bell System structure—which Section 333 seeks to dismantle—means to the telephone industry and its customers.

First, the Bell System structure gives our customers a total systems approach to their communications needs, to which Western Electric makes a vital contribution. This assures the compatibility, reliability, and quality of equipment needed for the efficient operation of the nationwide switched network.

Second, it assures us managers of the network that technical innovation will keep pace with customer needs and expectations. We cannot meet tomorrow's needs with yesterday's services. And that's what divestiture of Western Electric would force us to do.

Third, it makes it possible for us to provide services to all of our customers when they need them, where they need them. Our systems approach doesn't favor only business customers, or only people in large cities, or only those who can pay premium prices. It makes it possible for people in cities, suburbs, small towns and rural areas—people everywhere—to have reliable, economical long distance communications services.

Fourth, it makes it possible for the telephone companies and Long Lines to cope with disasters and to restore disrupted service quickly. This is possible only because of the unique team advantages that our integrated organization structure provides.

Fifth, it means substantial cost savings which are passed on to the consumer. For reasons which you've heard from other witnesses, divestiture of Western Electric would almost certainly result in higher price to the customer. AT&T Long Lines and the telephone operating companies would no longer have a captive supplier committed to Bell System service and objectives, rather than its own profit considerations. We would no longer enjoy the benefits of their economies of scale, ready inventories, short delivery and installation intervals, and collaborative design engineering that our systems approach provides. Divestiture, therefore, would hurt the American consumer in his pocketbook—his most sensitive area.

These, in general, are the benefits of the systems approach which the telephone customer stands to lose if Section 333 is passed into law.

The nationwide network is essential to fulfilling our basic mission of providing high quality, low-cost telecommunications service to the public. The network's facilities also provide sophisticated and secure communications systems for the government's military and civilian establishments, including early warning defense systems, space detection and tracking systems and airborne command posts.

The dynamics of customer needs and improvements in technology require the network to constantly grow and change. The extremely complex nature of this sophisticated network and the critical services it provides demand continuation of the vertically integrated structure of the Bell System.

This integration of research and development, manufacture, and operations ensures that the technical needs of the network are met in a timely, efficient and cost-effective manner. It provides the closely coupled, interactive relationship which facilitates continuous communications and feedback between managers and operators of the network, such as myself, and those who provide the technology needed to meet the requirements of that network. I know how much this means in meeting our service obligations

because I know what it takes to satisfy our customers.

There are 35,000 Long Lines employees throughout the U.S., 2,700 of whom work here in Illinois. Our job is to plan, engineer, construct and manage the network of long distance trunks and switching machines that tie together the telephone companies—both Bell System and independent—throughout the country, enabling telephone customers to talk to any other telephone customer throughout the United States. Of these customers, 3,300,000 with almost 8,000,000 telephones are served by Illinois Bell. We also provide overseas links that connect these same customers with others throughout the rest of the world.

Bell Telephone Laboratories does our basic research, design and development, and systems engineering. Just a few miles west of here, the Labs' Indian Hill facility at Naperville is responsible for the design and development of a family of electronic switching systems.

Western Electric has nearly 18,000 employees in Illinois. It has three manufacturing plants, a data processing center and a regional headquarters in the state. Western Electric's Service Center in West Chicago, jointly owned with Illinois Bell, warehouses material not just for Illinois Bell but for Long Lines as well.

Now, let me give you a specific example of how this Bell System team met the challenge of rapidly expanding customer demand for service in the Chicago metropolitan area.

A joint Long Lines/Illinois Bell long-range network planning study, completed in 1971, showed that long distance calling to and from the Chicago area was six times the volume of 1948 when we introduced the first electromechanical long distance switching machine in Chicago at 85 West Congress Street. Furthermore, long distance calling was growing at a compounded rate of more than 10 percent per year.

At such growth rates, we would require 15 or more electromechanical long distance switches in the Chicago area by 1990. This would have substantially increased the complexity of the network, significantly reduced its efficiency, and greatly increased its cost. In fact, much of the capacity of those machines would have been used up just to provide links between them in order that any customer in this area could call any other telephone in the United States and vice versa. This proliferation of electromechanical switchers was not an acceptable plan for efficiently meeting the future needs of our Chicago customers.

This study, together with similar studies for other large metropolitan areas, dramatically highlighted the need for a new long distance switcher of significantly greater capacity and higher speed. Resulting discussion and close teamwork between Long Lines and AT&T engineers with Bell Laboratories and Western Electric culminated in the development of the 4ESS switcher, an electronic toll switcher of more than four times the call-carrying capacity of its electromechanical predecessor. Despite this capacity, it requires only one-fifth the space, half the energy and one-third the maintenance cost of the older electromechanical systems with comparable capacity.

One of the largest and most complex projects ever developed by private enterprise, the very first 4ESS was put into service at our 10 South Canal Street building here in Chicago in January 1976. Since then, 19 similar switchers have been placed in service in major cities throughout the United States, including a second such machine in Chicago at 85 West Congress Street. That one went into service just last month.

Throughout this project development, there was continuous communication and feedback among all of the Bell System organizations involved. My engineering and operating people, along with their counterparts in Illinois Bell, were deeply involved.

Early discussions among members of the intercompany planning group laid the groundwork for a cost-saving team approach. Basic questions about the new

switcher had to be answered while broad design, manufacture and operating parameters were being established:

- First of all, what technology would be used? Electromechanical or electronic? Space division or time division switching? Hardware or software controlled?
- Would it be modular in design, so that its initial capacity could be expanded to meet future forecasted requirements?
- What would the ultimate capacity be?
- How could it be teamed with similar switchers in Chicago to further expand capacity and provide the alternate routing capability needed?
- What about cooling requirements? ments, and could it be adapted to fit existing available space?
- What about cooling requirements? Would present air-conditioning systems be adequate or would they have to be supplemented with new systems? How could we meet our needs in an energy-efficient manner?
- What operating systems and features would be provided to ensure "maintainability" by a minimum number of technicians?
- How would the total equipment installation be configured to optimize both the working conditions and the effectiveness of the operating personnel?
- Could Western Electric manufacture, install and test the new system in time to meet our required service date?

Our engineering and operating people needed answers to all these questions and hundreds more, long before design was finalized.

It is the vertically integrated structure of the Bell System that made it possible to find answers to these questions in a timely manner. That structure keeps all the members of the Bell System team in close touch. They continually talk to one another and feed back information needed by each member of the team. The result in this case was that it took less time and reduced the cost of introducing a major new technology into the network.

Because Western Electric was an integral part of our team, it was possible to start installation and testing of equipment while improvements were still being designed. Our operating and maintenance people acquired much of their initial hands-on training at the Western Electric assembly plant in Lisle before any equipment had been shipped and installed or formal training courses could be prepared.

All this telescoping effort and time results in major cost savings which flow through to Long Lines and Illinois Bell and ultimately to our customers. It is the public who benefits from this integrated systems approach. And it will be the public who will lose if the Bell System is struck the crippling blow of divestiture of Western Electric—the dismemberment of a system that works—as Section 333 of the proposed bill contemplates.

Even as this new generation of switchers is placed into service, the network continues to function smoothly. The 4ESS is compatible with generations of less sophisticated equipment already in place, including the earlier electromechanical system that it replaces. It works with the #1 Crossbar equipment installed on Chicago's South Side in 1940; it works with the #5 Crossbar installed in Chicago Heights in 1951; it works with the 1ESS installed in downtown Chicago in 1976. It could work, if we needed it, with the old panel switching equipment put into service on Chicago's North Side as long ago as 1928. And we know it will work with the newest electronic system we're planning in Huntley for 1982.

This kind of compatibility means a great deal to our customers. It enables us to meet their increasing needs for additional service, and at a reasonable price. We don't have to tear down the network and start all over with each new generation of technology.

In summary, I believe vertical integration of the Bell System is absolutely essential. It is not the structure of the Bell

System which dictates the network; rather, it is the network and its needs that dictate the Bell System structure.

Every component of the Bell System stands to lose if Western Electric is separated from the rest of the team. The nationwide network, in my view, will be hurt the worst. The blow could be crippling.

Section 333 as it is now written would ultimately require a splintering of the Bell System. I cannot see how this will result in any benefits to our customers that would outweigh the increased costs and degraded service they will experience.

Pick up your phone today and it works. You can talk to anybody in the United States and Canada and dial the call yourself. In fact, you can call millions of people all over the world.

Contrast this with the often frustrating experience of attempting to place a long distance call when traveling abroad. Americans are spared this problem, largely because of the integrated structure of our telecommunications system. And in this country you don't have to wait a year or more for your installation or pay an exorbitant price. Americans have something good going for them. And they know it. Why should they be asked to risk the dismantling of the finest telephone system in the world?

This year in Chicago, we're celebrating the 100th anniversary of telephone exchange service. Over that century, reliable, affordable telephone service has become something most Americans have come to take for granted. In fact, the relationship between the telephone and the American public has been like a happy marriage. It's my conviction that—given the facts—the public will staunchly defend that marriage contract.

That is why I urge that Section 333 of the Communications Act of 1978 be eliminated from the bill. □

UNITED STATES HOUSE OF REPRESENTATIVES
Committee on Interstate and Foreign Commerce
Subcommittee on Communications
Field Hearings
New Orleans, Louisiana

Statement of
Carl F. Bailey
on behalf of the
South Central Bell Telephone Company

September 23, 1978

I am Carl F. Bailey, Vice President of South Central Bell Telephone Company in Louisiana. My business address is 1215 Prytania Street, New Orleans.

I have held a variety of management positions during my 23 years of employment with the Bell System, working in four states, and have been the company's officer in charge of Louisiana operations since January, 1977.

My job is to manage the company's overall operations in Louisiana to insure that customers who *want* communications service *get* those services when and where they want them and at reasonable prices. In doing that job, I have obvious obligations as a corporate officer to the owners of the business, to the company's employees, and to our customers in Louisiana.

One of those obligations is to take issue with any action that poses a threat to the company's service capability. That's why I'm here today.

In taking issue with certain provisions of H.R. 13015 as it is presently drafted, I do not mean to criticize those responsible for drafting it. Other witnesses who have testified before this subcommittee have applauded Congress' recognition that a restatement of national communications policy is badly needed, and I join in that applause. The responsibility of the Subcommittee on Communications in restating that policy is an awesome one, and I appreciate your efforts.

But in the interests of the company and its Louisiana customers, I must state my concern about certain aspects of the draft bill which, in my opinion, would handcuff our capability to provide service promptly and efficiently.

As an operating telephone company manager, I cannot imagine satisfying customer demands for telephone service in Louisiana if the resolution of a new communications policy requires the divestiture of Western Electric and its half ownership in Bell Laboratories.

My attitude is not one of outraged concern because a "member of the family" faces the prospect of being kicked out. My concern is for the company and its customers in Louisiana. They are the ones who would have to pay the price—both literally and figuratively—for divestiture.

Let's consider that price in terms of what it could mean to the customer's pocketbook.

Last year, the company in Louisiana made purchases from Western Electric totaling nearly $205 million. We also purchased $97 million of products and services directly from suppliers *other* than Western Electric. Of the $205 million of equipment and services which we purchased from Western, $32 million were purchased by Western itself from non-Bell suppliers. Additionally, for use by Bell System companies throughout the country, Western Electric made purchases totaling $18.3 million from 766 separate suppliers in 49 Louisiana cities last year.

In his testimony before the Subcommittee on August 7, Dr. Morris Tanenbaum pointed out that Western Electric's prices for telecommunications products average about 20 percent below those of the lowest-priced general trade supplier. This means that based on our last year's purchases from Western, the company here in Louisiana saved more than $50 million. Using that same percentage difference in prices, savings over the past five years would amount to more than $200 million.

Our customers have to pay for the costs of service through the rates they pay. So, *they*—our customers—are the ones who benefited from the savings Western Electric afforded us.

Could these same savings be possible under a divestiture provision as suggested by H.R. 13015? Is there solid evidence—or even a hint—that Western Electric, if divested, would retain its prices 20 percent below those of other suppliers?

I believe logic indicates otherwise. Western Electric would become a profit-maximizing manufacturer. Its prices would seek the level of other general

trade suppliers. Thus, Western's prices would go up. Our costs would go up. And the price of telephone service to our customers would go up.

No one I know in the company here in Louisiana—or anywhere else in the Bell System for the matter—objects to change if it serves the public interest. But I do not see anything in the divestiture provision of this bill that serves the company's Louisiana customers. In my opinion, prices our customers would eventually have to pay for services could not keep from going up, simply as a result of divestiture. And I cannot see how any action that would result in higher prices—when there is no compelling reason for that action being taken in the first place—can be in the public interest. So, the imposition of an unnecessary and added cost burden on Louisiana customers is of great concern to me. That's just one concern.

Each year, the beginning of June signals the beginning of the hurricane season along the Gulf Coast. We don't breathe easily until the end of October. Some of those seasons have produced bumper crops of hurricanes, and some, fortunately, have not. But the threat of a major storm—or other natural disaster—is one that cannot be divested. The threat is forever with us.

Restoring communications in and after such disasters as quickly as possible is essential. It takes a coordinated effort, backed by a nationwide organization that can call in competent forces and compatible equipment from many areas. Let me give you a couple of examples.

Hurricane Betsy is still fresh in the minds of many Louisianians even though it happened nearly 13 years ago. The storm knocked 380,000 telephones out of service in Louisiana—the heaviest damage coming in the coastal communities, New Orleans, and Baton Rouge. Ninety-six of our central offices lost commercial power. Nearly 8,000 exchange cables were put out of commission. Seventy-six communities in Louisiana were virtually isolated when they were cut off from long distance service. The total damage estimate to Louisiana telephone facilities was in excess of $12 million.

There would have been no way for our Louisiana forces alone to get the restoration job done. In addition to hundreds of employees brought in from unaffected areas in our own company, four associated companies in the Bell System sent nearly 200 men and 134 vehicles to the South Louisiana area. They were on the job in a matter of hours.

Western Electric coordinated the shipment of tons of equipment to its distributing house in New Orleans. The equipment came from 12 different Western plants around the country. The shipments read like an equipment catalogue: PBX units of various types, thousands of telephone sets, frequency generators, over 100,000 pounds of assorted hardware and millions of feet of cable.

Within one week after the storm struck Louisiana, service had been restored to more than 226,000 telephones. The remainder of those damaged were restored in short order.

The effort involved a coordinated restoration plan of near mind-boggling proportions, and it wasn't a once-in-a-lifetime happening.

Less than four years later, Hurricane Camille hit the Mississippi-Louisiana gulf coast. The damage report was staggering: nearly 200,000 company telephones knocked out of service; 1,700 long distance circuits lost; 31 communities isolated from lack of communications facilities; 66 central offices on emergency power; 76 government circuits out of service; 41 PBX's (private branch exchanges) totally destroyed and 10 others partially destroyed. The overall cost to South Central Bell was about $16.2 million.

The restoration effort was like a replay of the one four years earlier.

Seven associated Bell companies sent 177 men and 163 vehicles to the Gulf Coast area to assist South Central Bell personnel. These were supplemented by personnel from AT&T's Long Lines Department and more than 200 Western

Electric installers.

Western Electric's New Orleans center became the coordinating point for all equipment shipments into the stricken areas. Within the first six days after the storm, Western Electric had coordinated the shipment of 43 truckloads of equipment weighing 442 tons to coastal areas of Mississippi and Louisiana. By the end of the 14th day after the storm, an additional 600 tons of equipment had been shipped by Western.

The equipment list included thousands of telephone sets, a billion conductor feet of exchange cable, 4 million feet of drop wire, 11 million feet of miscellaneous wire, 8,000 cable terminals, and assorted other equipment—all of which had to be compatible with existing equipment. The restoration job was accomplished in short order.

I'm sure Congressman Moore remembers well a day just this past May when the New Orleans and Baton Rouge areas were inundated by a ten-inch rainfall in the space of about four hours. Parts of both cities were flooded. In fact, in some parts of both New Orleans and Baton Rouge, we had more water than was brought in by either Hurricane Betsy or Camille. The damage report listed more than 100,000 telephones out of service. Many service pedestals were completely under water. Again, it took a coordinated response from Western Electric, South Central Bell, and associated company personnel to get the restoration job done.

The point of these examples is, I think, an obvious one. The advantages of a systems approach in responding to these and other kinds of communications problems have been pointed out by other witnesses appearing before this subcommittee.

Combining its resources to cope with an emergency is standard operating procedure with the Bell System, and it is a procedure that has worked many times to the benefit of the public. It works because of the unique combination of resources the Bell System can muster. It works because somebody at Western Electric is able almost immediately to determine what equipment is in stock, what is labeled for shipment somewhere else but can be diverted to the disaster area, and can coordinate the job of getting what is needed shipped where it is needed. It works because standardization of equipment, practices and training permits employees of one company to commence work immediately in another company's area just as skillfully and surely as if they were in their own home towns. And most importantly, Western Electric has the same priority and sense of urgency as the Bell System operating telephone company that is in trouble.

Those of us at South Central Bell in Louisiana could not begin to match those reactions and responses by ourselves. If divestiture of Western Electric took place today and a major hurricane or other disaster took place next week, I honestly do not know how or from where the needed restoration efforts would be coordinated. Faced with the prospect of having to check with dozens of other equipment suppliers to find out what equipment was available, whether or not it was compatible, how soon it could be shipped, and whether trained personnel were available to help install it, we simply could not accomplish restoration as quickly and as well as we are able to do it now. That prospect is frightening.

I suggest that the best anyone else could do under those circumstances is to promise that *maybe* the job could be done. But in times of such emergencies, victims can't use promises. They need service. And even if we came up with what we thought was the best alternative restoration plan possible under a divestiture provision, the period following a disaster is not the time to experiment. It is a time for reliable action—a time to serve the public need.

The thoughts I've expressed so far are, I suspect, natural reactions from a manager of the business who depends heavily on an organization like Western Electric to serve his customers. I need the help I get from them. I need a unified and coordinated systems approach to do the

communications job in Louisiana the way it ought to be done—the way our customers want it done.

There's another aspect of the divestiture provision that is of critical importance to the company and its customers.

Divestiture would separate Western Electric from the Bell Laboratories, and in the process destroy the relationship between Western, the Labs, and the operating companies. Without question, this would have a devastating effect on innovation and product development, and would be a disservice to customers everywhere.

I submit that the divestiture provision of the proposed Communications Act of 1978 threatens the reliability of service even in the best of times. And it would cripple our ability to respond to customer needs in the worst of times.

I join others who have asked the Subcommittee to delete the divestiture provision.

I want to thank Congressman Moore and Congressman Van Deerlin for bringing these important hearings to Louisiana. I especially appreciate your giving me the opportunity to share my concerns with you. □

William M. Ellinghaus
Vice Chairman, AT&T

A 38-year veteran of the Bell System, Mr. Ellinghaus has held a number of positions both at AT&T and in its operating telephone companies, including serving as president of New York Telephone Company from 1970 to 1976. His current responsibilities include federal and state regulatory matters, corporate planning, tariffs and costs, public affairs, public relations, and personnel and labor relations. He is also a member of AT&T's Executive Policy Committee and chairman of its Planning Council.

A native of Baltimore, Md., he is a director of 10 companies in addition to AT&T, chairman of the Regional Plan Association, vice chairman of the New York Chamber of Commerce and Industry, and a member of the Brookings Institution, Coalition to Save New York, and the Economic Club of New York, among others. In the past, he has served as chairman of the Mayor's Council of Economic and Business Advisors and the Municipal Assistance Corporation (of New York City).

Richard R. Hough
Executive Vice President, AT&T

Mr. Hough began his Bell System career in 1940 at Bell Telephone Laboratories, where he worked chiefly on the development of military weapons systems, including radar. He spent 17 years at Bell Labs before moving on to other executive assignments at AT&T, Ohio Bell Telephone Co., and AT&T Long Lines, where he served as president just prior to taking over his present assignment in 1978. He is responsible for engineering and network services. At Long Lines, he supervised the management of the interstate network and services, as well as all overseas operations. He was a Phi Beta Kappa at Princeton University (B.S.E. and E.E., 1940) and serves as a director of six corporations.

Morris Tanenbaum
President,
New Jersey Bell Telephone Company

After receiving a Ph.D. in Physical Chemistry from Princeton University, Dr. Tanenbaum went to work for Bell Laboratories in 1952. In addition to his personal work as a scientist, he has held executive positions in a number of Bell System units, including Bell Labs, Western Electric, and AT&T.

During his 26-year career, he has served on advisory committees at a number of universities and to the federal government. Dr. Tanenbaum is a member of the National Academy of Engineering and its council, and has served as a member of the Governing Board of the National Research Council. His professional association with the international community of scientists and engineers has taken him on visits and consultations to academic, governmental and industrial research, development, and production organizations all over the world.

Ian M. Ross
Executive Vice President, Systems Engineering & Development,
Bell Telephone Laboratories, Inc.

A 1952 Ph.D. graduate of Cambridge University (electrical engineering), Dr. Ross joined Bell Labs that same year in the Research Division, working on solid-state electronic devices. He has held a number of executive positions with Bell Labs while doing semiconductor and electron

tube research and development. In 1964, he was appointed managing director of Bellcomm Inc., a Bell System subsidiary which provided systems engineering support for the Apollo manned space flight program. He became president of Bellcomm in 1968. He has held his present position since 1976.

Robert E. Sageman
Vice President—Operations, AT&T Long Lines

Mr. Sageman has spent all but a few months of his 30 years in the Bell System with AT&T Long Lines. Prior to his current position he was assistant vice president, federal regulatory matters, at AT&T from April until December, 1976. A graduate of Rensselaer Polytechnic Institute, he is a member of Business Electronics Roundtable I, Communications Policy Board of IEEE Communications Society, Armed Forces Communications and Electronic Association, and the Association of Computing Machinery.

Charles Marshall
President, Illinois Bell Telephone Company

A Vandalia, Illinois native, Mr. Marshall has been with the Bell System for 25 years in a variety of management positions spanning the commercial, traffic, public relations, and financial departments. He has served as an operations officer for both Illinois Bell and Southwestern Bell (in Texas), and immediately prior to his present position was AT&T's Vice President and Treasurer.

Mr. Marshall is a member of the Economic Development Commission of the City of Chicago, Illinois Council on Economic Education (Governing Board), National Alliance of Businessmen (Advisory Council), and Sen. Charles Percy's Business Advisory Council, among other organizations.

Edward Goldstein
Assistant Financial Officer, AT&T

A graduate of the University of Minnesota with a degree in electrical engineering, Mr. Goldstein started his Bell System career in 1949 at Bell Laboratories. After 17 years with Bell Labs, he joined AT&T's Engineering Dept., where he was responsible for the introduction of electronic central offices into the Bell System. He later served as Vice President-Marketing for New York Telephone Co., and as a member of AT&T's Corporate Planning group. At the time he delivered the testimony in this book, he was Director of Product Management for AT&T, responsible for the product management of all of the Bell System's terminal equipment and data services.

He is a fellow of the Institute of Electrical and Electronic Engineers.

Richard B. Nichols
Vice President—Overseas, AT&T Long Lines

For the past six years, Mr. Nichols has had overall responsibility for directing the Long Lines Department's involvement in planning and providing telecommunications services between the United States and other countries. In the 32 years he has been with the Bell System, Mr. Nichols has held a variety of positions in government communications, engineering, operations and accounting.

Prior to his current assignment, he was Vice President-Marketing for AT&T Long Lines.

John F. Prendiville
Vice President-Engineering, New England Telephone & Telegraph Company

Since joining New England Telephone 30 years ago, Mr. Prendiville has held various managerial and technical jobs in all engineering functions, and in plant and network operations. He holds advanced degrees from Northeastern University and the Massachusetts Institute of Technology, from which he received a Master of Science degree in industrial management as a Sloan Fellow.

In addition to engineering, he is re-

sponsible for all real estate operations and central office installation for his company.

R. Douglas Watson
Vice President & General Manager, Central Area, AT&T Long Lines

Except for 21 months in AT&T's General Departments, all of Mr. Watson's 30-year Bell System career has been with Long Lines. In his present position, which he has held for the past 11 years, he is responsible for the overall management of interstate communications in a territory comprising Illinois, Wisconsin, Indiana, Ohio, Michigan and a small portion of northern Kentucky contiguous to Cincinnati.

A graduate of the Massachusetts Institute of Technology, he is a former president of the Chicago Chapter of the Armed Forces Communications and Electronics Association.

Carl F. Bailey
Vice President, Louisiana Area, South Central Bell Telephone Company

A native of Birmingham, Alabama, Mr. Bailey began his Bell System career with Southern Bell in 1952. He held a variety of positions with that company until 1968, when he transferred to Washington, D.C., as an executive assistant in AT&T's Federal Relations Dept. In 1971, he returned to Birmingham as assistant to the president of South Central Bell. He has been the company's chief executive officer in Louisiana since January, 1977.

A graduate of Auburn University, he is a director or a trustee of a number of civic organizations in Louisiana, including the Economic Development Council and the Metropolitan Area Commission.